

## **EXHIBIT I**

# EXHIBIT K

## UNITED STATES DISTRICT COURT MIDDLE DISTRICT OF NORTH CAROLINA

JOAQUÍN CARCAÑO *et al.*,

Plaintiffs,

*v.*

PATRICK MCCRORY *et al.*,

Defendants

CASE NO. 1:16-CV-00236-TDS-JEP

UNITED STATES OF AMERICA,

Plaintiff,

*v.*

CASE NO. 1:16-CV-00425-TDS-JEP

STATE OF NORTH CAROLINA *et al.*,

Defendants

### **DECLARATION OF LAWRENCE S. MAYER, MD, MS, PhD**

1. I have been retained by counsel for Defendants as an expert witness in connection with the above-captioned litigation.
2. I am a full-time academic involved in all aspects of teaching, research, and professional service. I am a medically trained biostatistician and epidemiologist who focuses on the design, analysis, and interpretation of experimental and observational data in public health and medicine, particularly when the data are complex in terms of underlying medical and scientific issues. I trained in medicine and psychiatry abroad, receiving a first level medical degree (M.B., the British Equivalent of an M.D.) in the United Kingdom. I then studied psychiatry and epidemiology before returning to the states to obtain an MS and

PhD in mathematics and statistics. I have never practiced psychiatry or clinical medicine and will not testify about any clinical issues. A copy of my CV is attached as Exhibit A.

3. My opinions as detailed in this declaration are based upon my knowledge and direct professional experience in the subject matters discussed. The materials that I have relied upon are the same types of materials that other experts in my field rely upon when forming opinions on the subject. A list of references and footnotes is included at the end of this declaration.

4. I have been a full-time tenured Professor for over four decades. I have held professorial appointments at nine universities including Princeton, the University of Pennsylvania, Stanford, Arizona State University, Johns Hopkins (Bloomberg School of Public Health and School of Medicine), The Ohio State University, Virginia Tech, University of Arizona, and the University of Michigan. I have held research faculty appointments at the Mayo Clinic, the Banner Alzheimer's Institute, and a senior management appointment (Director of Research) for Banner Health System, one of the largest hospital systems in the Western United States.

5. My full-time and part-time appointments have been in 23 disciplines or subdisciplines including, statistics, biostatistics, epidemiology, public health, social methodology, psychiatry, economics and biomedical informatics.

6. I have done extensive investigation into the existing research and epidemiological data on the transgender population.

7. Although I am a full-time academic researcher, over the last 40 years, I have testified in dozens of federal and state legal proceedings and regulatory proceedings. Most of them involved review of scientific literature in order to clarify the issues under examination in the

process. A list of my testimony is attached as Exhibit B.

8. I have also reviewed, as a methodologist hundreds of manuscripts submitted for publication to many of the major medical, statistical and epidemiological journals including *The New England Journal of Medicine* and *The Journal of the American Statistical Association*.

9. I am currently a Scholar in Residence, Department of Psychiatry, Johns Hopkins School of Medicine and a Professor of Statistics and Biostatistics, Arizona State University.

10. Up until the 1<sup>st</sup> of July, 2016, I also held part-time faculty appointments at the Johns Hopkins Bloomberg School of Public Health and School of Medicine, and at the Mayo Clinic, Scottsdale.

11. I may wish to supplement these opinions or the bases for them as a result of new scientific research or publications or in response to statements and issues that may arise in my area of expertise.

12. I am compensated at an hourly rate of \$400 per hour. My compensation does not depend on the outcome of this litigation, the opinions I express, or the testimony I provide.

### **Summary Opinions**

13. The concept of biological sex is well defined, based on the binary roles that males and females play in reproduction. By contrast, the concept of gender is not well defined. It is generally taken to refer to behaviors and psychological attributes that tend to be typical of a given sex. Some individuals identify as a gender that does not correspond to their biological sex. The causes of this identification remain poorly understood.

14. Research investigating whether these transgender individuals have certain physiological features or biological traits or experiences in common with the opposite sex,

such as brain structures or atypical prenatal hormone exposures, has so far been inconclusive.

15. Gender dysphoria—a sense of incongruence between one’s biological sex and one’s gender, accompanied by clinically significant distress or impairment.

16. Gender dysphoria is sometimes treated in adults by hormones or sex-reassignment surgery. There is little scientific evidence that these therapeutic interventions have psychological benefits and acceptable risks.

17. Science has shown that gender identity issues in children, if not encouraged (or even pressured) to change their gender, usually do not persist into adolescence or adulthood, and there is little scientific evidence for the therapeutic value of puberty-delaying pharmacologic treatments.

18. I am concerned about the lack of scientific support for the increasing trend toward encouraging children with gender identity issues to transition to expressing their gender through medical and then surgical procedures.

#### **“Sex,” “Gender,” and “Gender Identity”**

19. There seems to be a widely held popular belief that “gender identity”—the subjective, internal sense of being a man or a woman (or some other gender category)—is fixed at a very early age, or even at birth, and can diverge from a person’s biological sex. In the case of children, this is sometimes articulated by saying that a little boy may be trapped in a little girl’s body, or vice versa.

20. There is little scientific evidence that gender identity is fixed at an early age and none that it is present at birth. It is highly unlikely that newborns have any sense of themselves, let alone a sense of gender.

21. Though biological sex is fixed, and gender and biological sex are related in complex ways, they are not identical; gender is sometimes defined or expressed in ways that have little or nothing to do with biology.

22. To clarify what is meant by “gender” and “sex,” I refer to a widely used definition, here quoted from a pamphlet published by the American Psychological Association (APA):

*Sex* is assigned at birth, refers to one’s biological status as either male or female, and is associated primarily with physical attributes such as chromosomes, hormone prevalence, and external and internal anatomy. *Gender* refers to the socially constructed roles, behaviors, activities, and attributes that a given society considers appropriate for boys and men or girls and women. These influence the ways that people act, interact, and feel about themselves. While aspects of biological sex are similar across different cultures, aspects of gender may differ.<sup>1</sup>

This definition points to the obvious fact that there are social norms for men and women, norms that vary across different cultures and that are not simply determined by biology. But it goes further in holding that gender is almost entirely “socially constructed”, and thus, detached from biological sex.

23. In biology, an organism is male or female if it is structured to perform one of the respective roles in reproduction. This definition does not require any arbitrary measurable or quantifiable physical characteristics or behaviors; it requires understanding the reproductive system and the reproduction process. Different animals have different reproductive systems, but sexual reproduction occurs when the sex cells from the male and female of the species come together to form newly fertilized embryos. It is these reproductive roles that provide the conceptual basis for the differentiation of animals into the biological categories of male and female.

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<sup>1</sup> American Psychological Association, “Answers to Your Questions About Transgender People, Gender Identity and Gender Expression” (pamphlet), <http://www.apa.org/topics/lgbt/transgender.pdf>.

24. In mammals such as humans, the female gestates offspring and the male impregnates the female. More universally, the male of the species fertilizes the egg cells provided by the female of the species. This conceptual basis for sex roles is binary and stable, and allows us to distinguish males from females on the grounds of their reproductive systems, even when these individuals exhibit behaviors that are not typical of males or females.

25. Reproductive roles define the differences between the sexes even when behavior appears to be atypical for the particular sex. Consider, for example, the emperor penguin. Male emperor penguins provide warmth for eggs and nurturing of the young more than do females. In this sense, the male emperor penguin could be described as more maternal than the female.<sup>2</sup> However, we recognize that the male emperor penguin is not in fact female but rather that the species represents an exception to the general, but not universal, tendency among animals for females to provide more care than males for offspring. We recognize this because sex-typical behaviors such as nurturing do not define the sexes; the individual's role in sexual reproduction does.

26. Another example is that of Thomas Beatie, who made headlines as a man who gave live birth to three children between 2008 and 2010.<sup>3</sup> Thomas Beatie was born a woman, Tracy Lehuanani LaGondino, and underwent a surgical and legal transition to living as a man before deciding to have children. Because the medical procedures he underwent did not involve the removal of his ovaries or uterus, Beatie was capable of bearing children. The state of Arizona recognizes Thomas Beatie as the father of his three children, even though,

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<sup>2</sup> André Ancel, Michaël Beaulieu, and Caroline Gilbert, “The different breeding strategies of penguins: a review,” *Comptes Rendus Biologies* 336, no. 1 (2013): 6–7, <http://dx.doi.org/10.1016/j.crvi.2013.02.002>. Generally, male emperor penguins do the work of incubating the eggs and then caring for the chicks for several days after hatching. After that point, males and females take turns caring for the chicks.

<sup>3</sup> For an overview of Thomas Beatie’s story, see his book, *Labor of Love: The Story of One Man’s Extraordinary Pregnancy* (Berkeley: Seal Press, 2008).

biologically, he is their mother. Unlike the case of the male emperor penguin's ostensibly maternal, "feminine" parenting behavior, Beatie's ability to have children does not represent an exception to the normal inability of males to bear children. The labeling of Beatie as a man despite his being biologically female is a personal, social, and legal decision that was made without any basis in biology; nothing whatsoever in biology suggests Thomas Beatie is a male.

27. Scientifically speaking, transgender men are not biological men and transgender women are not biological women. The claims to the contrary are not supported by a scintilla of scientific evidence.

28. This definition of biological sex is not universally accepted. For example, philosopher and legal scholar Edward Stein maintains that infertility prohibits defining sex in terms of reproductive roles claiming that defining sex in terms of these roles would define "infertile males as females"<sup>4</sup> or postmenopausal females would be considered males.

29. Biological sex can still be defined strictly in terms of the structure of reproductive systems. Infertility can be caused by many problems. However, the reproductive system continues to exist for the purpose of producing children. Another point can be made about heterosexual couples who choose not to reproduce for any of a variety of reasons. The male and female reproductive systems are generally clearly recognizable, regardless of whether or not they are being used for purposes of reproduction.

30. The first major academic article to use the term "gender" appears to be the 1955 paper by the psychiatry professor John Money of Johns Hopkins on the treatment of

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<sup>4</sup> Edward Stein, *The Mismeasure of Desire: The Science, Theory, and Ethics of Sexual Orientation* (New York: Oxford University Press, 1999), 31.

“intersex” children (the term then used was “hermaphrodites”).<sup>5</sup> “Intersex” conditions refer to disorders of sexual development (“DSDs”) that render an individual’s sexual anatomy ambiguous. For example, the clitoris and penis are derived from the same embryonic structures. A baby may display an abnormally large clitoris or an abnormally small penis, causing its biological sex to be difficult to determine long after birth.

31. Money posited that gender identity, at least for intersex children, was fluid and that it could be constructed. In his mind, making a child identify with a gender only required constructing sex-typical genitalia and creating a gender-appropriate environment for the child. The chosen gender for these children was often female—a decision that was not based on genetics or biology, nor on the belief that these children were “really” girls, but, in part, on the fact that at the time it was easier surgically to construct a vagina than it was to construct a penis.

32. The most widely known patient of Dr. Money was David Reimer, a boy who was not born with an intersex condition but whose penis was damaged during circumcision as an infant.<sup>6</sup> David was raised by his parents as a girl named Brenda, and provided with both surgical and hormonal interventions to ensure that he would develop female-typical sex characteristics. However, the attempt to conceal from the child what had happened to him was not successful—he self-identified as a boy, and eventually, at the age of 14, his psychiatrist recommended to his parents that they tell him the truth. David then began the difficult process of reversing the hormonal and surgical interventions that had been performed to feminize his body. But he continued to be tormented by his childhood ordeal,

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<sup>5</sup> John Money, “Hermaphroditism, gender and precocity in hyperadrenocorticism: psychologic findings,” *Bulletin of the John Hopkins Hospital* 95, no. 6 (1955): 253–264, <http://www.ncbi.nlm.nih.gov/pubmed/14378807>.

<sup>6</sup> An account of the David Reimer story can be found in John Colapinto, *As Nature Made Him: The Boy Who Was Raised as a Girl* (New York: Harper Collins, 2000).

and took his own life in 2004, at the age of 38.

33. David Reimer is just one example of the harm wrought by theories that gender can socially and medically be reassigned in children. Biological sex is not a concept that can be reduced to, or artificially assigned on, the basis of the type of external genitalia alone. Genitalia correlates highly with, but it is not completely predictive, of the role in reproduction

34. Surgeons are becoming more capable of constructing artificial genitalia, but these anatomical alterations do not change the biological sex of the recipients, who are no more capable of playing the reproductive roles of the opposite biological sex than they were without the surgery. Nor does biological sex change as a function of the environment provided for the child. No degree of supporting a little boy in converting to be considered, by himself and others, to be a little girl makes him biologically a little girl. The scientific definition of biological sex is, for almost all human beings, clear, binary, and stable, reflecting an underlying biological reality that is not contradicted by exceptions to sex-typical behavior, and cannot be altered by surgery or social conditioning.

35. Research by William G. Reiner, a pediatric urologist and child and adolescent psychiatrist, and John P. Gearhart, a professor of pediatric urology indicates that gender is not arbitrary; it suggests that a biological male (or female) will probably not come to identify as the opposite gender after having been altered physically and immersed into the corresponding gender-typical environment. The plasticity of gender appears to have a limit.

36. In a 2004 paper, Reiner and Gearhart followed up on the sexual identities of 16 genetic males affected by cloacal exstrophy—a condition involving a badly deformed bladder and genitals. Of the 16 subjects, 14 were assigned female sex at birth, receiving

surgical interventions to construct female genitalia, and were raised as girls by their parents; 6 of these 14 later chose to identify as males, while 5 continued to identify as females. Two individuals declared themselves males at a young age but continued to be raised as females because their parents rejected the children's declarations. The remaining subject, who had been told at age 12 that he was born male, refused to discuss sexual identity.<sup>7</sup> So the assignment of female sex persisted in only 5 of the 13 cases with known results.

37. This lack of persistence is some evidence that the assignment of sex through genital construction at birth with immersion into a "gender-appropriate" environment is not likely to be a successful option for managing the rare problem of genital ambiguity from birth defects. This suggests that gender identity can be a complex and burdensome issue for those who choose (or have others choose for them) a gender identity opposite their biological sex. It is important to note that the ages of these individuals at last follow-up ranged from 9 to 19, so it is possible that more of them may have subsequently changed their gender identities.

38. In a 2004 article summarizing the results of research related to intersex conditions, Paul McHugh, the former chief of psychiatry at Johns Hopkins Hospital, suggested:

We in the Johns Hopkins Psychiatry Department eventually concluded that human sexual identity is mostly built into our constitution by the genes we inherit and the embryogenesis we undergo. Male hormones sexualize the brain and the mind. Sexual dysphoria—a sense of disquiet in one's sexual role—naturally occurs amongst those rare males who are raised as females in an effort to correct an infantile genital structural problem.<sup>8</sup>

39. Gender has been defined in terms of sex-typical traits and behaviors. Thus, being a

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<sup>7</sup> William G. Reiner and John P. Gearhart, "Discordant Sexual Identity in Some Genetic Males with Cloacal Extrophy Assigned to Female Sex at Birth," *New England Journal of Medicine*, 350 (January 2004): 333–341, <http://dx.doi.org/10.1056/NEJMoa022236>.

<sup>8</sup> Paul McHugh, "Surgical Sex: Why We Stopped Doing Sex Change Operations," *First Things* (November 2004): 37, <http://www.firstthings.com/article/2004/11/surgical-sex>.

boy means behaving in the ways boys typically behave—such as engaging in rough-and-tumble play and expressing an interest in sports and liking toy guns more than dolls. But this would imply that a boy who plays with dolls, hates guns, and refrains from sports or rough-and-tumble play might be considered to be a girl, rather than a boy who represents an exception to the typical patterns of male behavior. Sex-typical behavior is a poor means of identifying gender. Gender identity relies on an understanding of maleness and femaleness that is independent of these stereotypical “sex-appropriate” behaviors.

40. Scientific assertions that gender identity is innate or fixed at a young age and that gender identity has a strong biological basis are simply unsubstantiated. Scientific evidence shows that gender identity is fluid in childhood and can not be defined in terms of biology.

### **Gender Dysphoria and Transgenderism in Adults and Children**

41. As a way of surveying the biological and social science research on gender dysphoria, I can list a number of important questions:

- \* Are there biological factors that influence the development of a gender identity that does not correspond with one's biological sex?
- \* Are some individuals born with a gender identity different from their biological sex?
- \* Is gender identity shaped by environmental or nurturing conditions?
- \* How stable are choices of gender identity?
- \* How common is gender dysphoria? Is it persistent across the lifespan?
- \* Can a little boy who thinks he is a little girl change over the course of his life to regard himself as male? If so, how often can such people change their gender identities?
- \* How would someone's gender identity be measured scientifically?
- \* Does self-understanding suffice? Does a biological girl become a gender boy by believing, or at least stating, she is a little boy?

- \* Do people's struggles with a sense of incongruity between their gender identity and biological sex persist over the life course?
- \* Does gender dysphoria respond to psychiatric interventions? Should those interventions focus on affirming the gender identity of the patient or take a more neutral stance?
- \* Do efforts to hormonally or surgically modify an individual's primary or secondary sex characteristics help resolve gender dysphoria?
- \* Does modification create further psychiatric problems for some of those diagnosed with gender dysphoria, or does it typically resolve existing psychiatric problems?

42. While biological sex is, with very few exceptions, a well-defined, binary trait (male versus female) corresponding to how the body is organized for reproduction, "gender identity" is a more subjective attribute. For most people, their own gender is undoubtedly not a topic of concern; most biological males identify as boys or men, and most biological females identify as girls or women. However, some individuals experience an incongruence between their biological sex and their gender identity. If this struggle causes them to seek professional help, then the problem is classified as "gender dysphoria."

43. The cases of gender dysphoria that are the subject of much public debate are those in which an individual comes to identify as a gender different from their biological sex. These people are usually identified, and describe themselves, as "transgender."<sup>9</sup>

44. According to the fifth edition of the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders (DSM-5)*, gender dysphoria is marked by

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<sup>9</sup> A note on terminology: I generally use the term *transgender* to refer to persons for whom there is an incongruity between the gender identity they understand themselves to possess and their biological sex. We use the term *transsexual* to refer to individuals who have undergone medical interventions to transform their appearance to better correspond with that of their preferred gender. The most familiar colloquial term used to describe the medical interventions that transform the appearance of transgender individuals may be "sex change" (or, in the case of surgery, "sex-change operation"), but this is not commonly used in the scientific and medical literature today. While no simple terms for these procedures are completely satisfactory, in this declaration I employ the commonly used terms *sex reassignment* and *sex-reassignment surgery*, except when quoting a source that uses "gender reassignment" or some other term.

“incongruence between one’s experienced/expressed gender and assigned gender,” as well as “clinically significant distress or impairment in social, occupational, or other important areas of functioning.”<sup>10</sup>

45. It is important to clarify that gender dysphoria is not the same as gender nonconformity or gender identity disorder. Gender nonconformity describes an individual who behaves in a manner contrary to the gender-specific norms of his or her biological sex. As the *DSM-5* notes, most transvestites, for instance, are not transgender—men who dress as women typically do not identify themselves as women.<sup>11</sup> (However, certain forms of transvestism can be associated with late-onset gender dysphoria.<sup>12</sup>) Gender identity disorder, is an obsolete term from an earlier version of the *DSM* that was removed in its fifth edition. It was used as a psychiatric diagnosis. If we compare the diagnostic criteria for gender dysphoria (the current term) and gender identity disorder (the former term), we see that both require the patient to display “a marked incongruence between one’s experienced/expressed gender and assigned gender.”<sup>13</sup> The key difference is that a diagnosis of gender dysphoria requires the patient additionally to experience a “clinically significant distress or impairment in social, occupational, or other important areas of functioning” associated with these incongruent feelings.<sup>14</sup> Thus the major set of diagnostic criteria used in contemporary psychiatry does not designate all transgender individuals as having a psychiatric disorder. For example, a biological male who identifies himself as a female is not considered to have a

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<sup>10</sup> American Psychiatric Association, “Gender Dysphoria,” *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* [hereafter *DSM-5*] (Arlington, Va.: American Psychiatric Publishing, 2013), 452, <http://dx.doi.org/10.1176/appi.books.9780890425596.dsm14>.

<sup>11</sup> *Ibid.*, 458.

<sup>12</sup> *Ibid.*

<sup>13</sup> *Ibid.*, 452.

<sup>14</sup> *Ibid.*

psychiatric disorder unless the individual is experiencing significant psychosocial distress at the incongruence. A diagnosis of gender dysphoria may be part of the criteria used to justify sex-reassignment surgery or other clinical interventions. Furthermore, a patient who has had medical or surgical modifications to express his or her gender identity may still suffer from gender dysphoria. It is the nature of the struggle that defines the disorder, not the fact that the expressed gender differs from the biological sex. There is no scientific evidence, nor is it likely, that all transgender people have gender dysphoria, or that they are all struggling with their gender identities. Some individuals who are not transgender—that is, who do not identify as a gender that does not correspond with their biological sex—might nonetheless struggle with their gender identity; for example, girls who behave in some male-typical ways might experience various forms of distress without ever coming to identify as boys.

Conversely, individuals who do identify as a gender that does not correspond with their biological sex may not experience clinically significant distress related to their gender identity. Even if only, say, 40% of individuals who identify as a gender that does not correspond with their biological sex experience significant distress related to their gender identity, this would constitute a public health issue requiring clinicians and others to act to support those with gender dysphoria, and hopefully, to reduce the rate of gender dysphoria in the population. There is no evidence to suggest that the other 60% in this hypothetical—that is, the individuals who identify as a gender that does not correspond with their biological sex but who do not experience significant distress—would require clinical treatment.

46. The *DSM-5* criteria for a diagnosis of gender dysphoria in children are defined in a “more concrete, behavioral manner than those for adolescents and adults.”<sup>15</sup> This is to say

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<sup>15</sup> *Ibid.*, 454–455.

that some of the diagnostic criteria for gender dysphoria in children refer to behaviors that are stereotypically associated with the opposite gender. Clinically significant distress is still necessary for a diagnosis of gender dysphoria in children, but some of the other diagnostic criteria include, for instance, a “strong preference for the toys, games, or activities stereotypically used or engaged in by the other gender.”<sup>16</sup> What of girls that are “tomboys” or boys who are not oriented toward violence and guns, who prefer quieter play? Should parents worry that their tomboy daughter is really a boy stuck in a girl’s body?

47. The *DSM-5* criterion for diagnosing gender dysphoria by reference to gender-typical play preferences is unsound; it appears to ignore the fact that a child could display an *expressed* gender—manifested by social or behavioral traits—incongruent with the child’s biological sex but without *identifying* as the opposite gender. There is no scientific basis for believing that playing with toys typical of boys defines a child as a boy, or that playing with toys typical of girls defines a child as a girl.

48. Furthermore, even for children who do identify as a gender opposite their biological sex, diagnoses of gender dysphoria are simply unreliable. The reality is that they may have psychological difficulties in accepting their biological sex as their gender. Children can have difficulty with the expectations associated with those gender roles. Traumatic experiences can also cause a child to express distress with the gender associated with his or her biological sex.

49. Gender identity problems can also arise with intersex conditions<sup>17</sup> (the presence of

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<sup>16</sup> *Ibid.*, 452.

<sup>17</sup> American Psychiatric Association, “Gender Dysphoria,” *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (Arlington, Va.: American Psychiatric Publishing, 2014), <http://dx.doi.org/10.1176/appi.books.9781585625048.gg39>.

ambiguous genitalia due to genetic abnormalities), which were discussed earlier. These disorders of sex development, while rare, can contribute to gender dysphoria in some cases.<sup>18</sup>

50. A review of the neurobiological and genetic research on gender and gender identity provides virtually no evidence that the gender or gender identity has a biological basis.

51. Interpretations, usually in popular outlets, claiming or suggesting that a statistically significant difference between the brains of people who are transgender and those who are not is the cause of being transgendered or not—that is to say, that biological differences determine the differences in gender identity—are unwarranted. Current studies on associations between brain structure and transgender identity are small, methodologically limited, inconclusive, and sometimes contradictory. Even if they were more methodologically reliable, they would be insufficient to demonstrate that brain structure is a cause, rather than an effect, of the gender-identity behavior. They would likewise lack predictive power, the real challenge for any theory in science.

52. While there are many cases of gender dysphoria that are not associated with these identifiable intersex conditions, gender dysphoria may still represent a different type of intersex condition in which the primary sex characteristics such as genitalia develop normally while secondary sex characteristics associated with the brain develop along the lines of the opposite sex. Controversy exists over influences determining the nature of neurological, psychological, and behavioral sex differences. The emerging consensus is that there may be some differences in patterns of neurological development in- and ex-utero for men and women.<sup>i</sup> Therefore, in theory, transgender individuals could be subject to conditions allowing a more female-type brain to develop within a genetic male (having the XY chromosomal patterns), and vice versa. However, as we will show in the next section, Although emerging consensus recognizes that there may be some differences in patterns of neurological development in- and ex-utero for men and women,<sup>ii</sup> research supporting the

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<sup>18</sup> *Ibid.*, 457.

idea that such influences could account for transgenderism is quite minimal.

53. Robert Sapolsky, a Stanford professor of biology who has done extensive neuroimaging research, suggested a possible neurobiological explanation for transgenderism in a 2013 *Wall Street Journal* article, “Caught Between Male and Female.” He asserted that recent neuroimaging studies of the brains of transgender adults suggest that they may have brain structures more similar to their gender identity than to their biological sex.<sup>iii</sup> Sapolsky bases this assertion on the fact that there are differences between male and female brains, and while the differences are “small and variable,” they “probably contribute to the sex differences in learning, emotion and socialization.”<sup>iv</sup> He concludes: “The issue isn’t that sometimes people believe they are of a different gender than they actually are. Remarkably, instead, it’s that sometimes people are born with bodies whose gender is different from what they actually are.”<sup>v</sup> In other words, he claims that some people can have a female-type brain in a male body, or vice versa.

54. While this kind of neurobiological theory of transgenderism remains outside of the scientific mainstream, it has recently received extensive popular attention. It provides a potentially attractive explanation for transgenderism, especially for individuals who are not affected by any known genetic, hormonal, or psychosocial abnormalities.<sup>vi</sup> However, there is fairly little support in the scientific literature for Sapolsky’s contention. His neurological explanation for differences between male and female brains, and those differences’ possible relevance to transgenderism warrant further scientific consideration. There are many small studies that attempt to define causal factors of transgenderism, or of the experience of incongruence between one’s biological sex and felt gender. These studies are described in the following pages, each pointing to an influence that may contribute to the explanation for transgenderism, or gender dysphoria.

55. Nancy Segal, a psychologist and geneticist, researched two case studies of identical twins discordant for female-to-male (FtM) transsexualism.<sup>vii</sup> Segal notes that, according to another, earlier study that conducted nonclinical interviews with 45 FtM transsexuals, 60% suffered some form of childhood abuse, with 31% experiencing sexual abuse, 29% experiencing emotional abuse, and 38%

physical abuse.<sup>viii</sup> However, this earlier study did not include a control group and was limited by its small sample size, making it difficult to extract significant interactions, or generalizations, from the data.

56. Segal's own first case study was of a 34-year-old FtM twin, whose identical twin sister was married and the mother of seven children.<sup>ix</sup> Several stressful events had occurred during the twins' mother's pregnancy, and they were born five weeks prematurely. When they were eight years old, their parents divorced. The FtM twin exhibited gender-nonconforming behavior early and it persisted throughout childhood. She became attracted to other girls in junior high school and as a teenager attempted suicide several times. She reported physical abuse and emotional abuse at the hand of her mother. The twins were raised in a Mormon household, in which transsexuality was not tolerated.<sup>x</sup> The twin sister had never questioned her gender identity but did experience some depression. For Segal, the FtM twin's gender nonconformity and abuse in childhood were factors that contributed to gender dysphoria; the other twin was not subject to the same stressors in childhood, and did not develop issues around her gender identity. Segal's second case study also concerned identical twins with one twin transitioning from female to male.<sup>xi</sup> This FtM twin had early-onset nonconforming behaviors and attempted suicide as a young adult. At age 29 she underwent reassignment surgery, was well supported by family, met a woman, and married. As in the first case, the other twin was reportedly always secure in her female gender identity.

57. Segal speculates that each set of twins may have had uneven prenatal androgen exposures (although her study did not offer evidence to support this)<sup>xii</sup> and concludes that "Transsexualism is unlikely to be associated with a major gene, but is likely to be associated with multiple genetic, epigenetic, developmental and experiential influences."<sup>xiii</sup> Segal is critical of the notion that the maternal abuse experienced by the FtM twin in her first case study may have played a causal role in the twin's "atypical gender identification" since the abuse "apparently *followed*" the twin's gender-atypical behaviors—though Segal acknowledges "it is possible that this abuse reinforced his already atypical gender identification."<sup>xiv</sup> These case studies, while informative, are not scientifically strong,

and do not provide direct evidence for any causal hypotheses about the origins of atypical gender identification.

58. A source of more information—but also inadequate to make direct causal inferences—is a case analysis by Mayo Clinic psychiatrists J. Michael Bostwick and Kari A. Martin of an intersex individual born with ambiguous genitalia who was operated on and raised as a female. <sup>xv</sup> By way of offering some background, the authors draw a distinction between gender identity disorder (an “inconsistency between perceived gender identity and phenotypic sex” that generally involves “no discernible neuroendocrinological abnormality”<sup>xvi</sup>), and intersexuality (a condition in which biological features of both sexes are present). They also provide a summary and classification scheme of the various types of intersex disorders. After a thorough discussion of the various intersex developmental issues that can lead to a disjunction between the brain and body, the authors acknowledge that “Some adult patients with severe dysphoria—transsexuals—have neither history nor objective findings supporting a known biological cause of brain-body disjunction.”<sup>xvii</sup> These patients require thorough medical and psychiatric attention to avoid gender dysphoria.

59. After this helpful summary, the authors state that “Absent psychosis or severe character pathology, patients’ subjective assertions are presently the most reliable standards for delineating core gender identity.”<sup>xviii</sup> But it is not clear how we could consider subjective assertions more reliable in establishing gender identity, unless gender identity is defined as a completely subjective phenomenon. The bulk of the article is devoted to describing the various objectively discernible and identifiable ways in which one’s identity as a male or female is imprinted on the nervous and endocrine system. Even when something goes wrong with the development of external genitalia, individuals are more likely to act in accordance with their chromosomal and hormonal makeup.<sup>xix</sup>

60. In 2011, Giuseppina Rametti and colleagues from various research centers in Spain used MRI to study the brain structures of 18 FtM transsexuals who exhibited gender nonconformity early in life and experienced sexual attraction to females prior to hormone treatment. <sup>xx</sup> The goal was to learn whether their brain features corresponded more to their biological sex or to their sense of

gender identity. The control group consisted of 24 male and 19 female heterosexuals with gender identities conforming to their biological sex. Differences were noted in the white matter microstructure of specific brain areas. In untreated FtM transsexuals, that structure was more similar to that of heterosexual males than to that of heterosexual females in three of four brain areas.<sup>xxi</sup> In a complementary study, Rametti and colleagues compared 18 MtF transsexuals to 19 female and 19 male heterosexual controls.<sup>xxii</sup> These MtF transsexuals had white matter tract averages in several brain areas that fell between the averages of the control males and the control females. The values, however, were typically closer to the males (that is, to those that shared their biological sex) than to the females in most areas.<sup>xxiii</sup> In controls the authors found that, as expected, the males had greater amounts of gray and white matter and higher volumes of cerebrospinal fluid than control females. The MtF transsexual brain volumes were all similar to those of male controls and significantly different from those of females.<sup>xxiv</sup>

61. Overall, the findings of these studies by Rametti and colleagues do not sufficiently support the notion that transgender individuals have brains more similar to their preferred gender than to the gender corresponding with their biological sex. Both studies are limited by small sample sizes and lack of a prospective hypothesis—both analyzed the MRI data to find the gender differences and then looked to see where the data from transgender subjects fit.

62. Whereas both of these MRI studies looked at brain *structure*, a functional MRI study by Emiliano Santarecchi and colleagues from the University of Siena and the University of Florence looked at brain *function*, examining gender-related differences in spontaneous brain activity during the resting state.<sup>xxv</sup> The researchers compared a single FtM individual (declared cross-gender since childhood), and control groups of 25 males and 25 females, with regard to spontaneous brain activity. The FtM individual demonstrated a “brain activity profile more close to his biological sex than to his desired one,” and based in part on this result the authors concluded that “untreated FtM transsexuals show a functional connectivity profile comparable to female control subjects.”<sup>xxvi</sup> With a sample size of one, this study’s statistical power is virtually zero.

63. In 2013, Hsiao-Lun Ku and colleagues from various medical centers and research institutes in Taiwan also conducted functional brain imaging studies. They compared the brain activity of 41 transsexuals (21 FtMs, 20 MtFs) and 38 matched heterosexual controls (19 males and 19 females).<sup>xxvii</sup> Arousal response of each cohort while viewing neutral as compared to erotic films was compared between groups. All of the transsexuals in the study reported sexual attractions to members of their natal, biological sex, and exhibited more sexual arousal than heterosexual controls when viewing erotic films that depicted sexual activity between subjects sharing their biological sex. A “selfness” score was also incorporated into the study, in which the researchers asked participants to “rate the degree to which you identify yourself as the male or female in the film.”<sup>xxviii</sup> The transsexuals in the study identified with those of their preferred gender more than the controls identified with those of their biological gender, in both erotic films and neutral films. The heterosexual controls did not identify themselves with either males or females in either of the film types. Ku and colleagues claim to have demonstrated characteristic brain patterns for sexual attraction as related to biological sex but did not make meaningful neurobiological gender-identity comparisons among the three cohorts. In addition, they reported findings that transsexuals demonstrated psychosocial maladaptive defensive styles.

64. A 2008 study by Hans Berglund and colleagues from Sweden’s Karolinska Institute and Stockholm Brain Institute used PET and fMRI scans to compare brain-area activation patterns in 12 MtF transgendered individuals who were sexually attracted to women with those of 12 heterosexual women and 12 heterosexual men.<sup>xxix</sup> The first set of subjects took no hormones and had not undergone sex-reassignment surgery. The experiment involved smelling odorous steroids thought to be female pheromones, and other sexually neutral odors such as lavender oil, cedar oil, eugenol, butanol, and odorless air. The results were varied and mixed between the groups for the various odors, which should not be surprising, since *post hoc* analyses usually lead to contradictory findings.

65. The studies presented above show inconclusive evidence and mixed findings regarding the brains of transgender adults. Brain-activation patterns in these studies do not offer sufficient

evidence for drawing sound conclusions about possible associations between brain activation and sexual identity or arousal. The results are conflicting and confusing. Since the data by Ku and colleagues on brain-activation patterns are not universally associated with a particular sex, it remains unclear whether and to what extent neurobiological findings say anything meaningful about gender identity.

66. It is important to note that regardless of their findings, studies of this kind cannot support any conclusion that individuals come to identify as a gender that does not correspond to their biological sex because of an innate, biological condition of the brain. In most cases transgender individuals have been acting and thinking for years in ways that, through learned behavior and associated neuroplasticity—the fact that external stimuli can change the brain—may have produced brain changes that could differentiate them from other members of their biological or natal sex.

67. The only definitive way to establish epidemiological causality between a brain feature and a trait (especially one as elusive and vague as gender identity) would be to conduct prospective, longitudinal, preferably randomly sampled and population-based studies. The question is not simply whether there are differences between the brains of transgender individuals and people identifying with the gender corresponding to their biological sex, but whether gender identity is a fixed, innate, and biological trait, even when it does not correspond to biological sex, or whether environmental or psychological causes contribute to the development of a sense of gender identity in such cases. Neurological differences in transgender adults might be the consequence of biological factors such as genes or prenatal hormone exposure, or of psychological and environmental factors such as childhood abuse, or they could result from some combination of the two.

68. There are no serial, longitudinal, or prospective studies looking at the brains of cross-gender identifying children who develop to later identify as transgender adults. Lack of this research severely limits our ability to understand causal relationships between brain morphology, or functional activity, and the later development of gender identity different from biological sex.

69. More generally, it is now widely recognized among psychiatrists and neuroscientists who

engage in brain imaging research that there are inherent and ineradicable methodological limitations of *any* neuroimaging study that simply associates a particular trait, such as a certain behavior, with a particular brain morphology.<sup>xxx</sup> (And when the trait in question is not a concrete behavior but something as elusive and vague as “gender identity,” these methodological problems are even more serious.) These studies cannot provide statistical evidence nor show a plausible biological mechanism strong enough to support *causal connections* between a brain feature and the trait, behavior, or symptom in question. To support a conclusion of causality, even epidemiological causality, we need to conduct prospective longitudinal panel studies of a fixed set of individuals across the course of sexual development if not their lifespan.

70. Studies like these would use serial brain images at birth, in childhood, and at other points along the developmental continuum, to see whether brain morphology findings were there from the beginning. Otherwise, we cannot establish whether certain brain features caused a trait, or whether the trait is innate and perhaps fixed. Studies like those discussed above of individuals who already exhibit the trait are incapable of distinguishing between *causes* and *consequences* of the trait. In the absence of such prospective longitudinal studies, large representative population-based samples with adequate statistical controls for confounding factors may help narrow the possible causes of a behavioral trait and thereby increase the probability of identifying a neurological cause.<sup>xxxii</sup> However, because the studies conducted thus far use small convenience samples, none of them is especially helpful for narrowing down the options for causality. To obtain a better study sample, we would need to include neuroimaging in large-scale epidemiological studies. In fact, given the small number of transgender individuals in the general population,<sup>xxxiii</sup> the studies would need to be prohibitively large to attain findings that would reach statistical significance. Moreover, if a study found significant differences between these groups—that is, a number of differences higher than what would be expected by chance alone—these differences would refer to the average in a population of each group. Even if these two *groups* differed significantly for all 100 measurements, it would not necessarily indicate a biological difference among *individuals* at the extremes of the distribution.

Thus, a randomly selected transgender individual and a randomly selected non-transgender individual might not differ on any of these 100 measurements. Additionally, since the probability that a randomly selected person from the general population will be transgender is quite small, statistically significant differences in the sample means are not sufficient evidence to conclude that a particular measurement is predictive of whether the person is transgender or not. If we measured the brain of an infant, toddler, or adolescent and found this individual to be closer to one cohort than another on these measures, it would not imply that this individual would grow up to identify as a member of that cohort. It may be helpful to keep this caveat in mind when interpreting research on transgender individuals. In this context, it is important to note that there are no studies that demonstrate that any of the biological differences being examined have predictive power, and so all interpretations, usually in popular outlets, claiming or suggesting that a statistically significant difference between the brains of people who are transgender and those that are not is the cause of being transgendered or not—that is to say, that the biological differences determine the differences in gender identity—are unwarranted.

71. In short, the current studies on associations between brain structure and transgender identity are small, methodologically limited, inconclusive, and sometimes contradictory. Even if they were more methodologically reliable, they would be insufficient to demonstrate that brain structure is a cause, rather than an effect, of the gender-identity behavior. They would likewise lack predictive power, the real challenge for any theory in science.

72. For a simple example to illustrate this point, suppose we had a room with 100 people in it. Two of them are transgender and all others are not. I pick someone at random and ask you to guess the person's gender identity. If you know that 98 out of 100 of the individuals are not transgender, the safest bet would be to guess that the individual is not transgender, since that answer will be correct 98% of the time. Suppose, then, that you have the opportunity to ask questions about the neurobiology and about the natal sex of the person. Knowing the biology only helps in predicting whether the individual is transgender if it can improve on the original guess that the person is not

transgender. So if knowing a characteristic of the individual's brain does not improve the ability to predict what group the patient belongs to, then the fact that the two groups differ at the mean is almost irrelevant. Improving on the original prediction is very difficult for a rare trait such as being transgender, because the probability of that prediction being correct is already very high. If there really were a clear difference between the brains of transgender and non-transgender individuals, akin to the biological differences between the sexes, then improving on the original guess would be relatively easy. Unlike the differences between the sexes, however, there are no biological features that can reliably identify transgender individuals as different from others.

73. The consensus of scientific evidence overwhelmingly supports the proposition that a physically and developmentally normal boy or girl is indeed what he or she appears to be at birth. The available evidence from brain imaging and genetics does not demonstrate that the development of gender identity as different from biological sex is innate. Because scientists have not established a solid framework for understanding the causes of cross-gender identification, ongoing research should be open to psychological and social causes, as well as biological ones.

74. More generally, it is now widely recognized among psychiatrists and neuroscientists who engage in brain imaging research that there are inherent and ineradicable methodological limitations of *any* neuroimaging study that simply associates a particular trait, such as a certain behavior, with a particular brain morphology.<sup>19</sup> (And when the trait in question is not a concrete behavior but something as elusive and vague as "gender identity," these methodological problems are even more serious.) These studies cannot provide statistical evidence nor show a plausible biological mechanism strong enough to support *causal connections* between a brain feature and the trait, behavior, or symptom in question. To support a conclusion of causality, even epidemiological causality, we need to conduct prospective longitudinal panel studies of a fixed set of individuals across the course of sexual development if not their lifespan.

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<sup>19</sup> See, for example, Sally Satel and Scott D. Lilienfeld, *Brainwashed: The Seductive Appeal of Mindless Neuroscience*, (New York: Basic Books, 2013).

75. The consensus of scientific evidence overwhelmingly supports the proposition that a physically and developmentally normal boy or girl is indeed what he or she appears to be at birth. The available evidence from brain imaging and genetics does not demonstrate that the development of gender identity as different from biological sex is innate. Because scientists have not established a solid framework for understanding the causes of cross-gender identification, ongoing research should be open to psychological and social causes, as well as biological ones.

### **Treatment of Gender Dysphoria in Children and Adolescents**

76. Popular notion has inspired a gender-affirming approach to children who experience gender identity issues at an early age, but there is little evidence that gender identity issues have a high rate of persistence in children. According to the *DSM-5*, “In natal [biological] males, persistence [of gender dysphoria] has ranged from 2.2% to 30%. In natal females, persistence has ranged from 12% to 50%.”<sup>20</sup> Scientific data on persistence of gender dysphoria remains sparse due to the very low prevalence of the disorder in the general population, but the wide range of findings in the literature suggests that there is still much that we do not know about why gender dysphoria persists or desists in children. As the *DSM-5* entry goes on to note, “It is unclear if children ‘encouraged’ or supported to live socially in the desired gender will show higher rates of persistence, since such children have not yet been followed longitudinally in a systematic manner.”<sup>21</sup> There is a clear need for more research in these areas, and for parents and therapists to acknowledge the great uncertainty regarding how to interpret the behavior of these children.

77. With the uncertainty surrounding the diagnosis of and prognosis for gender dysphoria in children, therapeutic decisions are particularly complex and difficult. Therapeutic interventions for children must take into account the probability that the children may outgrow cross-gender

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<sup>20</sup> American Psychiatric Association, “Gender Dysphoria,” *DSM-5*, 455. Note: Although the quotation comes from the *DSM-5* entry for “gender dysphoria” and implies that the listed persistence rates apply to that precise diagnosis, the diagnosis of gender dysphoria was formalized by the *DSM-5*, so some of the studies from which the persistence rates were drawn may have employed earlier diagnostic criteria.

<sup>21</sup> *Ibid.*, 455.

identification.

78. University of Toronto researcher and therapist Kenneth Zucker believes that family and peer dynamics can play a significant role in the development and persistence of gender-nonconforming behavior, writing that

it is important to consider both predisposing and perpetuating factors that might inform a clinical formulation and the development of a therapeutic plan: the role of temperament, parental reinforcement of cross-gender behavior during the sensitive period of gender identity formation, family dynamics, parental psychopathology, peer relationships and the multiple meanings that might underlie the child's fantasy of becoming a member of the opposite sex.<sup>22</sup>

79. Zucker worked for decades with children experiencing feelings of gender incongruence, offering psychosocial treatments to help them embrace the gender corresponding with their biological sex—for instance, talk therapy, parent-arranged play dates with same-sex peers, therapy for co-occurring psychopathological issues such as autism spectrum disorder, and parent counseling.<sup>23</sup>

80. In a follow-up study by Zucker and colleagues of children treated by them over the course of thirty years at the Center for Mental Health and Addiction in Toronto, they found that gender identity disorder persisted in only 3 of the 25 girls they had treated.<sup>24</sup> (Zucker's clinic was closed by the Canadian government in 2015.<sup>25</sup>)

81. An alternative to Zucker's approach that emphasizes affirming the child's preferred gender

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<sup>22</sup> Kenneth J. Zucker, "Children with gender identity disorder: Is there a best practice?," *Neuropsychiatrie de l'Enfance et de l'Adolescence* 56, no. 6 (2008): 363, <http://dx.doi.org/10.1016/j.neurenf.2008.06.003>.

<sup>23</sup> Kenneth J. Zucker *et al.*, "A Developmental, Biopsychosocial Model for the Treatment of Children with Gender Identity Disorder," *Journal of Homosexuality* 59, no. 2 (2012), <http://dx.doi.org/10.1080/00918369.2012.653309>. For an accessible summary of Zucker's approach to treating gender dysphoria in children, see J. Michael Bailey, *The Man Who Would Be Queen: The Science of Gender-Bending and Transsexualism* (Washington, D.C.: Joseph Henry Press, 2003), 31–32.

<sup>24</sup> Kelley D. Drummond *et al.*, "A follow-up study of girls with gender identity disorder," *Developmental Psychology* 44, no. 1 (2008): 34–45, <http://dx.doi.org/10.1037/0012-1649.44.1.34>.

<sup>25</sup> Jesse Singal, "How the Fight Over Transgender Kids Got a Leading Sex Researcher Fired," *New York Magazine*, February 7, 2016, <http://nymag.com/scienceofus/2016/02/fight-over-trans-kids-got-a-researcher-fired.html>.

identity has become more common among therapists.<sup>26</sup> This approach involves helping the children to self-identify even more with the opposite sex.

82. One component of the gender-affirming approach has been the use of hormone treatments for adolescents in order to delay the onset of sex-typical characteristics during puberty and alleviate the feelings of dysphoria the adolescents will experience as their bodies develop sex-typical characteristics that are at odds with the gender with which they identify. There is relatively little evidence for the therapeutic value of these kinds of puberty-delaying treatments, but they are currently the subject of a large clinical study sponsored by the National Institutes of Health.<sup>27</sup>

83. The purpose of pubertal suppression with medications is to delay the onset of puberty in order to allow more time for the individual to make their decision as to their “gender identity.” Often it is a legal requirement since almost all surgeries are not done until a child reaches the age of consent.

84. While epidemiological data on the outcomes of medically delayed puberty is quite limited, referrals for sex-reassignment hormones and surgical procedures appear to be on the rise, and there is a push among many advocates to proceed with sex reassignment at younger ages. According to a 2013 article in *The Times* of London, the United Kingdom saw a 50% increase in the number of children referred to gender dysphoria clinics from 2011 to 2012, and a nearly 50% increase in referrals among adults from 2010 to 2012.<sup>28</sup> Whether this increase can be attributed to rising rates of gender confusion, rising sensitivity to gender issues, growing acceptance of therapy as an option, or

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<sup>26</sup> See, for example, American Psychological Association, “Guidelines for Psychological Practice with Transgender and Gender Nonconforming People,” *American Psychologist* 70 no. 9, (2015): 832–864, <http://dx.doi.org/10.1037/a0039906>; and Marco A. Hidalgo *et al.*, “The Gender Affirmative Model: What We Know and What We Aim to Learn,” *Human Development* 56 (2013): 285–290, <http://dx.doi.org/10.1159/000355235>.

<sup>27</sup> Sara Reardon, “Largest ever study of transgender teenagers set to kick off,” *Nature* 531, no. 7596 (2016): 560, <http://dx.doi.org/10.1038/531560a>.

<sup>28</sup> Chris Smyth, “Better help urged for children with signs of gender dysphoria,” *The Times* (London), October 25, 2013, <http://www.thetimes.co.uk/tto/health/news/article3903783.ece>. According to the article, in 2012 “1,296 adults were referred to specialist gender dysphoria clinics, up from 879 in 2010. There are now [in 2013] 18,000 people in treatment, compared with 4,000 15 years ago. [In 2012] 208 children were referred, up from 139 the year before and 64 in 2008.”

other factors, the increase itself is concerning, and merits further scientific inquiry into the family dynamics and other potential problems, such as social rejection or developmental issues, that may be taken as signs of childhood gender dysphoria.

85. A study of psychological outcomes following puberty suppression and sex-reassignment surgery, published in the journal *Pediatrics* in 2014 by child and adolescent psychiatrist Annelou L.C. de Vries and colleagues, suggested improved outcomes for individuals after receiving these interventions, with well-being improving to a level similar to that of young adults from the general population.<sup>29</sup> This study looked at 55 transgender adolescents and young adults (22 MtF and 33 FtM) from a Dutch clinic who were assessed three times: before the start of puberty suppression (mean age: 13.6 years), when cross-sex hormones were introduced (mean age: 16.7 years), and at least one year after sex-reassignment surgery (mean age: 20.7 years). The study did not provide a matched group for comparison—that is, a group of transgender adolescents who did not receive puberty-blocking hormones, cross-sex hormones, and/or sex-reassignment surgery—which makes comparisons of outcomes more difficult.

86. In the study cohort, gender dysphoria improved over time, body image improved on some measures, and overall functioning improved modestly. Due to the lack of a matched control group it is unclear whether these changes are attributable to the procedures or would have occurred in this cohort without the medical and surgical interventions. Measures of anxiety, depression, and anger showed some improvements over time, but these findings did not reach statistical significance. While this study suggested some improvements over time in this cohort, particularly the reported subjective satisfaction with the procedures, detecting significant differences would require the study to be replicated with a matched control group and a larger sample size. The interventions also included care from a multidisciplinary team of medical professionals, which could have had a beneficial effect. Future studies of this kind would ideally include long-term follow-ups that assess outcomes

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<sup>29</sup> Annelou L.C. de Vries *et al.*, “Young Adult Psychological Outcome After Puberty Suppression and Gender Reassignment,” *Pediatrics* 134, no. 4 (2014): 696–704, <http://dx.doi.org/10.1542/peds.2013-2958d>.

and functioning beyond the late teens or early twenties.

#### **Treatment of Gender Dysphoria in Adults: Sex Reassignment Surgery**

87. As for therapeutic intervention in adults: The high level of uncertainty regarding various outcomes after sex-reassignment surgery makes it difficult to find clear answers about the effects on patients of reassignment surgery. The potential that patients undergoing medical and surgical sex reassignment may want to return to a gender identity consistent with their biological sex suggests that reassignment carries considerable psychological and physical risk, especially when performed in childhood, but also in adulthood. It suggests that the patients' pre-treatment beliefs about an ideal post-treatment life may sometimes go unrealized.

88. In 2004, Birmingham University's Aggressive Research Intelligence Facility (Arif) published an assessment of the findings of more than one hundred follow-up studies of post-operative transsexuals.<sup>30</sup> An article in *The Guardian* summarized the findings:

Arif...concludes that none of the studies provides conclusive evidence that gender reassignment is beneficial for patients. It found that most research was poorly designed, which skewed the results in favour of physically changing sex. There was no evaluation of whether other treatments, such as long-term counselling, might help transsexuals, or whether their gender confusion might lessen over time. Arif says the findings of the few studies that have tracked significant numbers of patients over several years were flawed because the researchers lost track of at least half of the participants. The potential complications of hormones and genital surgery, which include deep vein thrombosis and incontinence respectively, have not been thoroughly investigated, either. "There is huge uncertainty over whether changing someone's sex is a good or a bad thing," says Dr. Chris Hyde, director of Arif. "While no doubt great care is taken to ensure that appropriate patients undergo gender reassignment, there's still a large number of people who have the surgery but remain traumatized—often to the point of committing suicide."

89. The high level of uncertainty regarding various outcomes after sex-reassignment

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<sup>30</sup> David Batty, "Mistaken identity," *The Guardian*, July 30, 2004, <http://www.theguardian.com/society/2004/jul/31/health.socialcare>.

surgery makes it difficult to find clear answers about the effects on patients of reassignment surgery. Since 2004, there have been other studies on the efficacy of sex-reassignment surgery, using larger sample sizes and better methodologies. Some of the more informative and reliable studies on outcomes for individuals receiving sex-reassignment surgery are examined below.

90. As far back as 1979, Jon K. Meyer and Donna J. Reter published a longitudinal, follow-up study on the overall well-being of adults who underwent sex-reassignment surgery.<sup>31</sup> The study compared the outcomes of 15 people who received surgery with those of 35 people who requested but did not receive surgery (14 of these individuals eventually received surgery later, resulting in three cohorts of comparison: operated, not-operated, and operated later). Well-being was quantified using a scoring system that assessed psychiatric, economic, legal, and relationship outcome variables. Scores were determined by the researchers after performing interviews with the subjects. Average follow-up time was approximately five years for subjects who had sex change surgery, and about two years for those subjects who did not.

91. Compared to their condition before surgery, the individuals who had undergone surgery appeared to show some improvement in well-being, though the results had a fairly low level of statistical significance. Individuals who had no surgical intervention did display a statistically significant improvement at follow-up. However, there was no statistically significant difference between the two groups' scores of well-being at follow-up. The authors concluded that "sex reassignment surgery confers no objective advantage in terms of social rehabilitation, although it remains subjectively satisfying to those who have rigorously

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<sup>31</sup> Jon K. Meyer and Donna J. Reter, "Sex Reassignment: Follow-up," *Archives of General Psychiatry* 36, no. 9 (1979): 1010–1015, <http://dx.doi.org/10.1001/archpsyc.1979.01780090096010>.

pursued a trial period and who have undergone it.”<sup>32</sup> This study led the psychiatry department at Johns Hopkins Medical Center (JHMC) to discontinue surgical interventions for sex changes for adults.<sup>33</sup>

92. However, the study has important limitations. Selection bias was introduced in the study population, because the subjects were drawn from those individuals who sought sex-reassignment surgery at JHMC. In addition, the sample size was small. Also, the individuals who did not undergo sex-reassignment surgery but presented to JHMC for it did not represent a true control group. Random assignment of the surgical procedure was not possible. Large differences in the average follow-up time between those who underwent surgery and those who did not further reduces any capacity to draw valid comparisons between the two groups. Additionally, the study’s methodology was also criticized for the somewhat arbitrary and idiosyncratic way it measured the well-being of its subjects. Co-habitation or any form of contact with psychiatric services were scored as equally negative factors as having been arrested.<sup>34</sup>

93. In 2011, Cecilia Dhejne and colleagues from the Karolinska Institute and Gothenburg University in Sweden published one of the more robust and well-designed studies to examine outcomes for persons who underwent sex-reassignment surgery. Focusing on mortality, morbidity, and criminality rates, the matched cohort study compared a total of 324 transsexual persons (191 MtFs, 133 FtMs) who underwent sex reassignment between 1973 and 2003 to two age-matched controls: people of the same sex as the transsexual person at

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<sup>32</sup> *Ibid.*, 1015.

<sup>33</sup> See, for instance, Paul R. McHugh, “Surgical Sex,” *First Things* (November 2004), <http://www.firstthings.com/article/2004/11/surgical-sex>.

<sup>34</sup> Michael Fleming, Carol Steinman, and Gene Bocknek, “Methodological Problems in Assessing Sex-Reassignment Surgery: A Reply to Meyer and Reter,” *Archives of Sexual Behavior* 9, no. 5 (1980): 451–456, <http://dx.doi.org/10.1007/BF02115944>.

birth, and people of the sex to which the individual had been reassigned.<sup>35</sup>

94. Given the relatively low number of transsexual persons in the general population, the size of this study is impressive. Unlike Meyer and Reter, Dhejne and colleagues did not seek to evaluate the patient satisfaction after sex-reassignment surgery, which would have required a control group of transgender persons who desired to have sex-reassignment surgery but did not receive it. Also, the study did not compare outcome variables before and after sex-reassignment surgery; only outcomes after surgery were evaluated. We need to keep these caveats in mind as we look at what this study found. These two caveats need to be kept in mind.

95. Dhejne and colleagues found statistically significant differences between the two cohorts on several of the studied rates. For example, the postoperative transsexual individuals had an approximately three times higher risk for psychiatric hospitalization than the control groups, even after adjusting for prior psychiatric treatment.<sup>36</sup> (However, the risk of being hospitalized for substance abuse was not significantly higher after adjusting for prior psychiatric treatment, as well as other covariates.) Sex-reassigned individuals had nearly a three times higher risk of all-cause mortality after adjusting for covariates,<sup>37</sup> although the elevated risk was significant only for the time period of 1973–1988. Those undergoing surgery during this period were also at increased risk of being convicted of a crime.<sup>38</sup> Most alarmingly, sex-reassigned individuals were 4.9 times more likely to attempt

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<sup>35</sup> Cecilia Dhejne *et al.*, “Long-term follow-up of transsexual persons undergoing sex reassignment surgery: cohort study in Sweden,” *PLOS ONE* 6, no. 2 (2011): e16885, <http://dx.doi.org/10.1371/journal.pone.0016885>.

<sup>36</sup> 95% confidence interval: 2.0–3.9.

<sup>37</sup> 95% confidence interval: 1.8–4.3.

<sup>38</sup> MtF transsexuals in the study’s 1973–1988 period showed a higher risk of crime compared to the female controls, suggesting that they maintain a male pattern for criminality. That study period’s FtM transsexuals, however, did

suicide and 19.1 times more likely to die by suicide compared to controls.<sup>39</sup> “Mortality from suicide was strikingly high among sex-reassigned persons, including after adjustment for prior psychiatric morbidity.”<sup>40</sup>

96. The study design precludes drawing inferences “as to the effectiveness of sex reassignment as a treatment for transsexualism,” although Dhejne and colleagues state that it is possible that “things might have been even worse without sex reassignment.”<sup>41</sup> Overall, post-surgical mental health was quite poor, as indicated especially by the high rate of suicide attempts and all-cause mortality in the 1973–1988 group. (It is worth noting that for the transsexuals in the study who underwent sex reassignment from 1989 to 2003, there were of course fewer years of data available at the time the study was conducted than for those transsexuals from the earlier period. The rates of mortality, morbidity, and criminality in the later group may in time come to resemble the elevated risks of the earlier group.) In summary, this study suggests that sex-reassignment surgery may not rectify the comparatively poor health outcomes associated with transgender populations in general. Still, because of the limitations of this study mentioned above, the results also cannot establish that sex-reassignment surgery causes poor health outcomes.

97. In 2009, Annette Kuhn and colleagues from the University Hospital and University of Bern in Switzerland examined post-surgery quality of life in 52 MtF and 3 FtM

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show a higher risk of crime compared to the female controls, perhaps related to the effects of exogenous testosterone administration.

<sup>39</sup> 95% confidence intervals: 2.9–8.5 and 5.8–62.9, respectively.

<sup>40</sup> *Ibid.*, 6.

<sup>41</sup> *Ibid.*, 7.

transsexuals fifteen years after sex-reassignment surgery.<sup>42</sup> This study found considerably lower general life satisfaction in post-surgical transsexuals as compared with females who had at least one pelvic surgery in the past. The postoperative transsexuals reported lower satisfaction with their general quality of health and with some of the personal, physical, and social limitations they experienced with incontinence that resulted as a side effect of the surgery. Again, inferences cannot be drawn from this study regarding the efficacy of sex-reassignment surgery due to the lack of a control group of transgender individuals who did not receive sex-reassignment surgery.

98. In 2010, Mohammad Hassan Murad and colleagues from the Mayo Clinic published a systematic review of studies on the outcomes of hormonal therapies used in sex-reassignment procedures, finding that there was “very low quality evidence” that sex reassignment via hormonal interventions “likely improves gender dysphoria, psychological functioning and comorbidities, sexual function and overall quality of life.”<sup>43</sup> The authors identified 28 studies that together examined 1,833 patients who underwent sex-reassignment procedures that included hormonal interventions (1,093 male-to-female, 801 female-to-male).<sup>44</sup> Pooling data across studies showed that, after receiving sex-reassignment procedures, 80% of patients reported improvement in gender dysphoria, 78% reported improvement in psychological symptoms, and 80% reported improvement in quality of life.<sup>45</sup> None of the studies included the bias-limiting measure of randomization (that is, in

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<sup>42</sup> Annette Kuhn *et al.*, “Quality of life 15 years after sex reassignment surgery for transsexualism,” *Fertility and Sterility* 92, no. 5 (2009): 1685–1689, <http://dx.doi.org/10.1016/j.fertnstert.2008.08.126>.

<sup>43</sup> Mohammad Hassan Murad *et al.*, “Hormonal therapy and sex reassignment: a systematic review and meta-analysis of quality of life and psychosocial outcomes,” *Clinical Endocrinology*, 72 (2010): 214–231. <http://dx.doi.org/10.1111/j.1365-2265.2009.03625.x>.

<sup>44</sup> *Ibid.*, 215

<sup>45</sup> 95% confidence intervals: 68–89%, 56–94%, and 72–88%, respectively.

none of the studies were sex-reassignment procedures assigned randomly to some patients but not to others), and only three of the studies included control groups (that is, patients who were not provided the treatment to serve as comparison cases for those who did).<sup>46</sup> Most of the studies examined in Murad and colleagues' review reported improvements in psychiatric comorbidities and quality of life, though notably suicide rates remained higher for individuals who had received hormone treatments than for the general population, despite reductions in suicide rates following the treatments.<sup>47</sup> The authors also found that there were some exceptions to reports of improvements in mental health and satisfaction with sex-reassignment procedures; in one study, 3 of 17 individuals regretted the procedure with 2 of these 3 seeking reversal procedures,<sup>48</sup> and four of the studies reviewed reported worsening quality of life, including continuing social isolation, lack of improvement in social relationships, and dependence on government welfare programs.<sup>49</sup>

99. The scientific evidence suggests we take a skeptical view toward the claim that sex-reassignment procedures provide the hoped-for benefits or resolve the underlying issues that contribute to elevated mental health risks among the transgender population. While we work to stop maltreatment and misunderstanding, we should also work to study and understand whatever factors may contribute to the high rates of suicide and other psychological and behavioral health problems among the transgender population, and to think more clearly about the treatment options that are available. Critiquing and challenging the notion that there is a fixed gender independent of biological sex enables us to ask important questions

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<sup>46</sup> *Ibid.*

<sup>47</sup> *Ibid.*, 216

<sup>48</sup> *Ibid.*

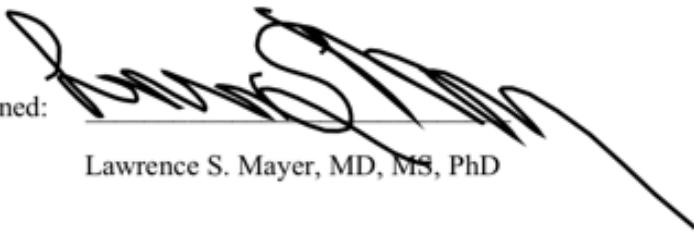
<sup>49</sup> *Ibid.*, 228

about sexuality, sexual behaviors, gender, and individual and social goods in a different light. Thoughtful scientific research and careful, circumspect interpretation of its results can advance our understanding of sexual gender identity. There is still much work to be done and many unanswered questions.

100. I reserve the right to expand on this declaration if given additional evidence or given additional testimony of other witnesses to review

101. Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct.

Signed:



Lawrence S. Mayer, MD, MS, PhD

Date: August 12, 2016

## References

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<sup>i</sup> For one recent review of the science of neurological sex differences, see Amber N.V. Ruigrok *et al.*, “A meta-analysis of sex differences in human brain structure,” *Neuroscience Biobehavioral Review* 39 (2014): 34–50, <http://dx.doi.org/10.1016%2Fj.neubiorev.2013.12.004>.

<sup>iii</sup> Robert Sapolsky, “Caught Between Male and Female,” *Wall Street Journal*, December 6, 2013, <http://www.wsj.com/articles/SB10001424052702304854804579234030532617704>.

<sup>iv</sup> *Ibid.*

<sup>v</sup> *Ibid.*

<sup>vi</sup> For some examples of popular interest in this view, see Francine Russo, “Transgender Kids,” *Scientific American Mind* 27, no. 1 (2016): 26–35, <http://dx.doi.org/10.1038/scientificamericanmind0116-26>; Jessica Hamzelou, “Transsexual differences caught on brain scan,” *New Scientist* 209, no. 2796 (2011): 1, <https://www.newscientist.com/article/dn20032-transsexual-differences-caught-on-brain-scan/>; Brynn Tannehill, “Do Your Homework, Dr. Ablow,” The Huffington Post, January 17, 2014, [http://www.huffingtonpost.com/brynn-tannehill/how-much-evidence-does-it\\_b\\_4616722.html](http://www.huffingtonpost.com/brynn-tannehill/how-much-evidence-does-it_b_4616722.html).

<sup>vii</sup> Nancy Segal, “Two Monozygotic Twin Pairs Discordant for Female-to-Male Transsexualism,” *Archives of Sexual Behavior* 35, no. 3 (2006): 347–358, <http://dx.doi.org/10.1007/s10508-006-9037-3>.

<sup>viii</sup> Holly Devor, “Transsexualism, Dissociation, and Child Abuse: An Initial Discussion Based on Nonclinical Data,” *Journal of Psychology and Human Sexuality*, 6 no. 3 (1994): 49–72, [http://dx.doi.org/10.1300/J056v06n03\\_04](http://dx.doi.org/10.1300/J056v06n03_04).

<sup>ix</sup> Segal, “Two Monozygotic Twin Pairs Discordant for Female-to-Male Transsexualism,” 350.

<sup>x</sup> *Ibid.*, 351.

<sup>xi</sup> *Ibid.*, 353–354.

<sup>xii</sup> *Ibid.*, 354.

<sup>xiii</sup> *Ibid.*, 356.

<sup>xiv</sup> *Ibid.*, 355. Emphasis in original.

<sup>xv</sup> J. Michael Bostwick and Kari A. Martin, “A Man’s Brain in an Ambiguous Body: A Case of Mistaken Gender Identity,” *American Journal of Psychiatry*, 164 no. 10 (2007): 1499–1505, <http://dx.doi.org/10.1176/appi.ajp.2007.07040587>.

<sup>xvi</sup> *Ibid.*, 1500.

<sup>xvii</sup> *Ibid.*, 1504.

<sup>xviii</sup> *Ibid.*, 1504.

<sup>xix</sup> *Ibid.*, 1503–1504.

<sup>xx</sup> Giuseppina Rametti *et al.*, “White matter microstructure in female to male transsexuals before cross-sex hormonal treatment. A diffusion tensor imaging study,” *Journal of Psychiatric Research* 45, no. 2 (2011): 199–204, <http://dx.doi.org/10.1016/j.jpsychires.2010.05.006>.

<sup>xxi</sup> *Ibid.*, 202.

<sup>xxii</sup> Giuseppina Rametti *et al.*, “The microstructure of white matter in male to female transsexuals before cross-sex hormonal treatment. A DTI study,” *Journal of Psychiatric Research* 45, no. 7 (2011): 949–954, <http://dx.doi.org/10.1016/j.jpsychires.2010.11.007>.

<sup>xxiii</sup> *Ibid.*, 952.

<sup>xxiv</sup> *Ibid.*, 951.

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<sup>xxv</sup> Emiliano Santarecchi *et al.*, “Intrinsic Cerebral Connectivity Analysis in an Untreated Female-to-Male Transsexual Subject: A First Attempt Using Resting-State fMRI,” *Neuroendocrinology* 96, no. 3 (2012): 188–193, <http://dx.doi.org/10.1159/000342001>.

<sup>xxvi</sup> *Ibid.*, 188.

<sup>xxvii</sup> Hsiao-Lun Ku *et al.*, “Brain Signature Characterizing the Body-Brain-Mind Axis of Transsexuals,” *PLOS ONE* 8, no. 7 (2013): e70808, <http://dx.doi.org/10.1371/journal.pone.0070808>.

<sup>xxviii</sup> *Ibid.*, 2.

<sup>xxix</sup> Hans Berglund *et al.*, “Male-to-Female Transsexuals Show Sex-Atypical Hypothalamus Activation When Smelling Odorous Steroids,” *Cerebral Cortex* 18, no. 8 (2008): 1900–1908, <http://dx.doi.org/10.1093/cercor/bhm216>.

<sup>xxx</sup> An additional clarification may be helpful with regard to research studies of this kind. Significant differences in the means of sample populations do not entail predictive power of any consequence. Suppose that we made 100 different types of brain measurements in cohorts of transgender and non-transgender individuals, and then calculated the means of each of those 100 variables for both cohorts. Statistical theory tells us that, due to mere chance, we can (on average) expect the two cohorts to differ significantly in the means of 5 of those 100 variables. This implies that if the significant differences are about 5 or fewer out of 100, these differences could easily be by chance and therefore we should not ignore the fact that 95 other measurements failed to find significant differences.

<sup>xxxi</sup> One recent paper estimates that 0.6% of the adult U.S. population is transgender. See Andrew R. Flores *et al.*, “How Many Adults Identify as Transgender in the United States?” (white paper), Williams Institute, UCLA School of Law, June 30, 2016, <http://williamsinstitute.law.ucla.edu/wp-content/uploads/How-Many-Adults-Identify-as-Transgender-in-the-United-States.pdf>.

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Mayer, L.S., Hoyer, R.W., and Bernd, J.L. (1977). "Some Problems in the Validation of Mathematical and Stochastic Models of Political Phenomena: The Case of the Supreme Court," American Journal of Political Science, 21, 381-403

Mayer, L.S. and Younger, M.S. (1976). "Estimation of Standardized Regression Coefficients," Journal of the American Statistical Association, 71, 154-157

Mayer, L.S. and Robinson, J.A. (1977). "Measures of Association for Multiple Regression Models with Ordinal Predictor Variables," Sociological Methodology, 1978, Jossey-Bass, 141-162

Jensen, D.R. and Mayer, L.S. (1977). "Some Variational Results and Their Applications to Problems in Multiple Inference," Annals of Statistics, 5, 922-931

Horowitz, C.E. and Mayer, L.S. (1977). "The Relationship Between the Price and Demand for Natural Gas: A Partially Controlled Study," Energy Research, 1, 193-222

Hoyer, R.W. and Mayer, L.S. (1976). "On Electoral Equilibria in a Spatial Analysis Based on the Theory of Games," Journal of Politics, 38, 116-171

Hoyer, R.W. and Mayer, L.S. (1975). "On Social Preference Orderings Under Majority Rule," Econometrica, 43, 803-806

Mayer, L.S., and Good, I.J. (1975). "Is Minimax Regret Applicable to Voting Decisions? American Political Science Review, 69, 916-917

Good, I.J. and Mayer, L.S. (1975). "Estimating the Efficacy of a Vote," Behavioral Science, 20, January, 25-33

Mayer, L.S. and Younger, M.S. (1975). "Multiple Indicators and the Relationship Between Abstract Variables," Sociological Methodology, 1975, 191-211

Jensen, D.R. and Mayer, L.S. (1975). "Normal-Theory Approximations to Tests for Linear Hypotheses," Annals of Statistics, 3, 429-444

Jensen, D.R., Mayer, L.S. and Myers, R.H. (1975). "Optimal Designs and Large-Sample Tests for Linear Hypotheses," Biometrika, 62, 71-78

Hoyer, R.W. and Mayer, L.S. (1974). "Comparing Strategies in a Spatial Model of Electoral Competition," American Journal of Political Science, 18, 501-523

Bush, W. and Mayer, L.S. (1974). "Some Implications of Anarchy for the Distribution of Property," Journal of Economic Theory, 4, 401-411

Mayer, L.S., Singh, J. and Willke, T.A. (1974). "Utilizing Initial Estimates in Estimating the Coefficients in a Linear Model," Journal of the American Statistical Association, 69, 219-222

Mayer, L.S. and Younger, M.S. (1974). "Procedures for Estimating Standardized Regression Coefficients from Sample Data," Sociological Methods and Research, 1, 431-453

Mayer, L.S. and Good, I.J. (1974). "On Ordinal Prediction Problems," Social Forces, 52 (4), 543-549

Mayer, L.S. (1974). "On the Use of Non-Random Exogenous Variables in Path Analysis," American Sociological Review, 39, 891-893

Klemmack, D.L., Leggette, T.A. and Mayer, L.S. (1973). "Non-Random Exogenous Variables in Path Analysis," American Sociological Review, 38 (December), 778-784

Mayer, L.S. and Hendrickson, A. (1973). "A Method for Constructing an Optimal Regression Design After an Initial Set of Input Values Has Been Selected," Communications in Statistics, 2(5), 465-477

Mayer, L.S. and Willke, T.A. (1973). "On Biased Estimation in Linear Models," Technometrics, 15, 497-508

Mayer, L.S. (1973). "Estimating a Correlation Coefficient When One Variable is Not Directly  
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Observed," Journal of the American Statistical Association, 68, 420-421

Burgess, P.M. and Mayer, L.S. (1973). "Simulation and Society, A Review Essay," Journal of Regional Science, 12, 303-311

Good, I.J. and Mayer, L.S. (1973). "On Surfaces of Constant Societal Loss in a Model of Social Choice," Journal of Mathematical Sociology, 2, 209-219

Mayer, L.S. (1972). "Using Monotone Regression to Estimate a Correlation Coefficient," Sociological Methodology, (Herbert Costner, ed.), Jossey-Bass: San Francisco, 200-212

Mayer, L.S. (1972). "An Analysis of Measures of Crosscutting and Fragmentation," Comparative Politics, 4, 405-415

Mayer, L.S. (1971). "Comment on 'The Assignment of Numbers to Rank Order Categories'," American Sociological Review, 35, 916-917

Mayer, L.S. (1971). "A Note on Treating Ordinal Data as Interval Data," American Sociological Review, 36, 519-520

Mayer, L.S. (1971). "A Note on An Axiomatic Model of Voting Bodies," American Political Science Review, 65, 764-65

Mayer, L.S. (1971). "A Method of Cluster Analysis When There Exists Multiple Indicators of a Theoretic Concept," Biometrics, 27, 143-155

Mayer, L.S. (1971). "A Comment on 'A Theorem on Voting'," American Political Science Review, 65, 779-780

### **Research Monographs:**

Energy Consumption Measurement: Data Needs for Public Policy, (1977) Committee on Measurement of Energy Consumption, Washington: National Academy of Science

Mayer, L.S. (1976). An Analysis of Alternative Voter Registration Systems, Modules in Applied Mathematics, Washington: Mathematical Association of America

### **Chapters in Research Monographs:**

Mayer, L. S. (1994) "On Cross-Lagged Panel Studies with Serially Correlated Errors," Frontiers in Econometrics, G. Maddala (ed), 154-165

Mayer, L.S. (1980). "The Effects of Price on Energy Demand: Econometrics Versus Exploratory Data Analysis," in Evaluation of Econometric Models (J. Kmenta and J. Ramsey, eds.), Academic Press, 15-45

Mayer, L.S. and Benjamin, Y. (1980). "Modelling Residential Demand for Natural Gas as a Function of the Coldness of the Month," in Saving Energy in the Home, (R. Socolow, ed.) New York: Ballinger

Bush, W. and Mayer, L.S. (1976). "On the Economics of Human Fertility," in Essays on Unorthodox Economic Strategies: Anarchy, Politics and Population, (A.T. Denzau and R.J. Mackay, eds.), University Publications, 163-181

Mayer, L.S. (1974). "Optimal Voting Behavior in a Two-Party Primary", in Applications of Mathematics in Political Science, Vol. VIII, (J. Herndon and J. Bernd, eds.), Charlottesville: University of Virginia Press, 4-14

### **Published Book Reviews**

On the Verge: The Legal Fight of Travellers in England for their Rights (many authors), Romani Studies, 2001, 144-146

Firms and Markets (C. Tucker and R. Fuller, eds.), Perspective, Winter, 1988, 41

Social Science and Social Policy (R. Shotland and M. Mark, eds.), Perspective, April, 1986, 60

Principles of Epidemiology (Kleinbaum, Kupper and Morgenstern) Journal of the American Statistical Association, July/August 1984, 108

U.S. Interests and Global Natural Resources (Castle and Price, eds.), Perspective, September, 1984, 725-726

Proximity and Preference: Problems in the Multidimensional Analysis of Large Data Sets (R. Golledge and J. Raynor, eds.), Journal of the American Statistical Association, September, 1983, 78, 734

Statistical Applications in the Spatial Sciences (N. Wrigley, ed.), Journal of the American Statistical Association, June, 1983, 78, 509-510

Power, Voting, and Voting Power (Manfred J. Holler, ed.), Perspective, February, 1983

Exploratory Data Analysis (J. Tukey), Evaluation and Program Planning, 1981, 4, 195-196

On the Social Use of Information (A. Wissel), Perspective, June, 1977, Vol. 6, No. 5

Simulation Model Building: A Statistical Approach to Modeling in the Social Sciences With The Simulation Method (U. Norlen), Perspective, March 1977, Vol. 6, No. 2

Research Methods in the Social Sciences (D. Nachimas and C. Nachimas), Perspective, November 1976, Vol. 5, No. 9

Registering Voters by Mail: The Maryland and New Jersey Experience (R. Smolka), Perspective, October 1975, Vol. 4, No. 8

### **Other Professional Activities:**

Guest Lecture, Statistics and Epidemiology in Court, University of Maryland Law School, March, 2012

Editorial Board Member, Journal of Cardiology Research, 2003-

Member, Development Board, Copper Ridge Institute, Sykesville, MD, 1998-2000

Member, Expert Panel, Sexually Transmitted Disease and Teens, W. T. Grant Foundation, 2000-2001

Advisor, Sexually Transmitted Diseases & the Internet, American Social Health Association, 2000-2001

Invited Member, Panel on Mental Health Problems of Asylum Seekers, University of Greenwich, July 2000

Invited participant, Expert Panel on Mortality Associated with Alternative Fuels, Department of Energy, Carmel, May, 2000

Chief, Epidemiology and Biostatistics Branch, Phoenix Integrated Residency in Cardiology, 1999-

Clinical Professor, Prevention Center, College of Medicine, University of Arizona, 1999-

Member, Faculty of the Psychiatry Residency Program, Good Samaritan, 1998 –

Member of the Board of Directors, Palms Clinic, Phoenix, 1998-

Invited Participant, US Environmental Protection Agency Expert Panel on Cryptosporidium, October, 1998

Member, Evaluation Panel, Graduate Programs, University of Greenwich, London, August, 1998

Expert Witness, Appropriations Hearing on NIH Budget, US Senate, October, 1997-

Member, Expert Review Committee on Grant Applications and Awards, Health Care and Promotion Fund, Hong Kong, 1996-1998

Member, Clinical Committee, Health Services Advisory Group, Arizona, [the arm of the Medicare system that advises Medicare on reimbursements], 1994-1996

Alternate Member, Institutional Review Board, Samaritan Health Systems 1994-2001

Invited Attendee, Workshop on Psychosocial Research, American Psychiatric Association, Massachusetts General Hospital, Boston, October, 1996

Invited Attendee, Risk Estimation Conference, Environmental Protection Agency, Durham, North Carolina, September, 1996

Invited Attendee, Society for Prevention Research, Annual Conference, Puerto Rico, May, 1996

Proposal Evaluation Site Visit, Raptor Research Center, Boise State University, March 1996

Workshop Attendee, The Epidemiology of Avian Mortality, California Energy Commission, Sacramento, California, January, 1996

Invited Attendee, Prevention Science and Methodology Conference, Baltimore, MD, October, 1995

Invited Attendee, Avian Windpower Planning Meeting, Palm Springs, September, 1995

Invited Attendee, US Department of Energy Course on Risk Assessment, Boulder, July 1995

Invited Attendee, Mini-conference on Measuring Health Outcomes, Phoenix, March 1995

Invited Attendee, Private Conference on Wind Energy Research, California Energy Commission,  
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Grand Island, California, December, 1994

Invited Participant, Workshop on Prevention Methodology, University of South Florida, Baltimore, December, 1994

Invited Participant, National Conference on Prevention Research, Washington, DC, December, 1994

Invited Consultant, California Energy Commission, Flagstaff, Arizona, November, 1994

Invited Participant, Workshop on the Science of Prevention, NIMH, Baltimore, December, 1994

Invited Participant, Meeting on Renewable Energy, California Energy Commission, Flagstaff, Arizona, November, 1994

Invited Participant, Workshop on Prevention Methodology, Oregon Social Learning Center, Eugene Oregon, August, 1994

Invited Technical Advisor, National Planning Meeting on Wind Power and Avian Mortality, Lakewood, CO, July, 1994

Invited Participant, Workshop on Biostatistical Methods in Preventive Mental Health Research, College of Public Health, University of South Florida, Tampa, March, 1994

Invited Participant, Biomedical Effects of Renewable Energy, Invited Conference, US Department of Energy, Washington, DC February, 1994

Member, Special Study Section, National Institute of Health, 1993-

Invited Participant, Avian Mortality Taskforce Meeting, October, Pleasanton, CA, December, 1993

Invited Participant, Conference on Avian Mortality and Wind Energy, Pacific Gas and Electric, Livermore, CA, October, 1993

Invited Participant, Prevention Center Directors Meeting, National Institute of Mental Health, Tysons Corner, September, 1993

Invited Participant, National Conference on Prevention Research, McLean, Virginia, April, 1993.

Invited Participant, Prevention Center Directors Meeting, National Institute of Mental Health, Rockville, September, 1992

Invited Participant, Prevention Center Directors Meeting, National Institute of Mental Health, Rockville, September, 1991

Invited Participant, Conference on the Future of Prevention Research, National Institute of Mental Health, Washington, DC, July, 1991

Invited Participant, Workshop on Development of Delinquency, National Academy of Science, Woods Hole Study Center, July, 1991

Invited Participant, Workshop on Preventive Research, National Institute of Mental Health, October, 1990

Invited Lecturer, Exploratory Data Analysis, The Bootstrap and Panel Models in Occupational Medicine, lecture series, College of Business Administration, University of Canterbury, Christchurch, New Zealand, September - October, 1989

Invited Host, Mini-conference on The Epidemiology of Bladder Cancer, August, 1988, Lenox, Massachusetts

Expert Witness, Department of Public Health, Commonwealth of Massachusetts, July, 1988

Expert Witness, Department of Labor and Industry, Commonwealth of Massachusetts, July, 1988

Invited Participant, Workshop in Multidimensional Analysis, Information Theory and Asymptotic Methods, Stanford University, July 1983

Assisted in Preparation and Coordination, Conference on Science and Technology in the Soviet Union, Stanford University, July, 1983

Session Organizer, International Conference on Energy Use Management, Berlin, October, 1981

Member, Committee on Industrial Use of Solar Energy, Solar Energy Research Institute, Golden, Colorado, 1979-1981

Press Conference on Wharton's Support to Litigation Project Award, April, 1981, Philadelphia

Invited Participant, Workshop on Model Validation, Department of Economics, New York University, April, 1980.

Expert Witness, Hearings on Energy Tax Exemptions, Energy Committee, Pennsylvania State Assembly, April, 1980

Lecturer, Workshop in Environmental Policy, Florida Atlantic University, March, 1980

Interviewed on Feasibility of Philadelphia's Refinery Tax Proposal, WUSL Radio, Philadelphia, November, 1980

Member, Committee on Health Manpower Training, Department of Health, New Jersey, 1976-79.

Interviewed on Model Validation, WPEN Radio, Philadelphia, November, 1979.

Interviewed on Value of Energy Forecasts, Philadelphia Inquirer, October, 1979.

Invited Panelist, Panel on Energy Models in Energy Policy-making, Program in Science Technology and Public Policy, George Washington University, Washington, D.C., October, 1979

Organizer, Workshop on Resource Estimation, Department of Energy Statistical Symposium, Gatlinburg, Tennessee, October, 1979

Session Chairperson, Special Topics Meetings on Regression, Institute of Mathematical Statistics, October, 1979

Invited Participant, Workshop on the Measurement and Interpretation of Model Confidence, National Bureau of Standards, U.S. Department of Commerce, Washington, D.C., October, 1979

Invited Participant, Workshop on Measuring Model Confidence, National Bureau of Standards, Gaithersburg, MD, October 1979

Expert Witness, Hearings on State Health Benefits, Ohio State Assembly, February, 1979

Member, Committee on Model Evaluation, General Accounting Office, United States Congress, 1977-1978.

Participant, Workshop on Assessment of Energy Models, Massachusetts Institute of Technology, October, 1978.

Organizer, Session on Multivariate Statistics, Annual Meeting, Institute of Mathematical Statistics, August, 1978

Lecturer, Program on Environmental Management, Florida Atlantic University, April, 1978

Expert Witness, Hearings on Local Energy Policies, Subcommittee on Energy and Power, Committee on Interstate and Foreign Commerce, U.S. House of Representatives, May, 1978

Invited Panelist, Policy Workshop on Energy Policy, Swarthmore College, March, 1978

Chairperson, Committee on Membership, Institute of Mathematical Statistics, 1974-78

Invited Participant, Workshop on Energy Information, Stanford University, December 1977

Invited Participant, Conference on Criteria for Evaluation of Econometric Models, University of Michigan, June 1977

Expert Witness, Hearings on Health Impacts of Energy Conservation, Commerce Committee, US House Representatives, April, 1977

Conference Chair, Conference on the Analysis of Large Data Sets, Institute of Mathematical Statistics and American Statistical Association, Dallas, February 1977

Panelist, Seminars on Models and Energy Policy, Program in Public Policy, George Washington University, February, 1977

Invited Participant, Workshop on Stochastic Models of Social Structure Carnegie-Mellon University, MSSB Workshop, Pittsburgh, December, 1977

Interviewed on Energy Policy, West Virginia Public Television Network, October, 1976

Member, Committee on Measurement of Energy Consumption, National Academy of Sciences, 1975-76

Interviewed on Energy Policy, West Virginia Public Television Network, October, 1976

Participant, Workshop on Model Building, Mathematical Association of America, Cornell University, August, 1976

Organizer and Chair, Session on Voting Models, Annual Meeting of the Public Choice Society, Roanoke, VA, April, 1976

Instructor, Short Course on Advances in Data Analysis, Princeton University, April, 1976

Member, Organizing Committee, Annual Convention, Institute of Mathematical Statistics, 1975-76

Member, Site Review Committee, University of Texas, San Antonio, National Science Foundation, 1975

Participant, Workshop on Validation of Econometric Models, National Science Foundation, Vail, Colorado, June, 1975

Participant, Workshop on Decentralization Theory, National Science Foundation, Princeton University, March, 1975

Member of the Council, Polymetrics Section, International Studies Association, 1973-75

Member, Committee on Education of Gifted Children, Department of Education, Virginia, 1973-74

Member, Committee on Health Training, State Council of Higher Education, Virginia, 1973-74

Instructor, Workshop on Survey Research, University of Cologne, Cologne, West Germany, 1973

Lecturer, Institute on Model Building, National Science Foundation, Blacksburg, Virginia, August, 1973

Clinical Assistant [Clinical Rotations], Associated Medical Schools, British Virgin Islands, 1969-1970

Summer Fellow, College of Medicine, University of Michigan, Summer, 1970

**Major Consulting Appointments (Other than Public and Non-profit):**

Play an active advisory role to several CEO's, corporate medical directors, courts, boards, and non-profits on specific health issues, which are confidential, private, proprietary or privileged. I would be glad to discuss these activities in an executive session. They are not appropriate for open documentation.

**Major Consulting Appointments (Public and Non-profit):**

Consultant in Research Compliance, Maricopa Integrated Medical System, 2002-2003

Consultant, California Energy Commission, 1994-2002

Consultant, National Renewable Energy Laboratory, 1992-1996

Consultant, Department of Mental Hygiene, Johns Hopkins Medical Institutions, June-August, 1990-1993

Consultant, Program on Delinquency, Child and Maternal Health, Harvard School of Public Health, 1991.

Consultant, Committee on the Courts, Arizona Supreme Court, 1988-1989.

Consultant, Bonneville Power Authority, 1986-1988.

Consultant, Special Counsel, Department of Energy, 1979-82.

Consultant, National Governors Association, 1979-81

Consultant, Environmental Monitoring Project, Environmental Protection Agency, 1979

Consultant, Energy Office, State of New York, 1976-78

Consultant, Department of Health, City of New York, 1976-78

Consultant, Center for the Study of Emergency Health Services, University of Pennsylvania, 1977

Consultant, Chancellor, The University of Missouri, 1976

Consultant, National Commission on Water Quality, 1974-76

Consultant, Trout Unlimited, 1976

Consultant, Policy Analysis Division, Department of Housing and Urban Development, 1974

Consultant, Department of Political Science, Ohio State University, 1974

Consultant, Committee on State Employee Benefits, Assembly of the State of Ohio, 1973

Consultant, Department of Preventive Medicine, Ohio State University, 1972-73

**Editorial Service:**

Abstract Review Board, Annual Meeting, Society for General Internal Medicine, 1995

Member, Editorial Board, Sociological Methodology, Publication of the American Sociological Association, 1979-1983

Associate Editor, Series on Social Methodology, Sage Publications, 1974-81

Member, Editorial Board, Journal of Politics, 1974-81

Associate Editor, Journal of the American Statistical Association, 1977-79

Abstracter, Executive Sciences Incorporated, 1974-79

Abstracter, Mathematical Reviews, 1974-76

Proposal reviewer for a variety of public agencies. In 1991-93 reviewed proposals for NIH, NIMH, NSF, DOE, EPA and others

Manuscript reviewer for several publishers including John Wiley and Sons and Wadsworth

**Honors and Awards:**

Listed in the International Who's Who in Medicine, 1997-

Listed in Who's Who in Medicine, 1994-

Honorary Member, Phi Beta Phi, Honorary Society, inducted 1991

Distinguished Research Professor, Arizona State University, 1987-88

Fellow, Royal Statistical Society, elected November, 1984.

Listed in Who's Who in the West, 1983-

Listed in Who's Who in Medical Research, 1982-

Listed in Personalities in America, 1981-

Listed in Distinguished Educators, 1982-

Member, Phi Beta Kappa, inducted 1967

Member, Alpha Iota Delta (Decision Science Honorary Society), elected 1986

Distinguished Alumni Award, Ohio State University, 1971

Awardee, Graduate Scholarship, National Science Foundation, 1967

Recipient, President's Scholarship Award, Ohio State University, 1968

Recipient, President's Scholarship Award, Ohio State University, 1967

**Research Grants and Contracts:**

Co-Principal Investigator, Alzheimer's Disease and Anti-Inflammatory Prevention: Is Elevated Serum Cholesterol Predictive of Developing AD?, D. Larry Sparks, PI, Institute for the Study of Aging, funded, March 2001, 360,000

Biostatistical Problems in Research Methodology, Samaritan Health Services, Principal Investigator: L.S. Mayer, 1996-2003, approximate award 450,000

Statistical Problems in Developing Intermediate Outcome Models of the Role of Apolipoprotein E in Alzheimer's Disease, Office of Research, Arizona State University, 1994-95, approximate award 20,000.

Biostatistical Problems in Research Methodology, Samaritan Health Services, Principal Investigator: L.S. Mayer, 1995-96, approximate award 26,000

Co-Principal Investigator, Prevention Research Training Grant, awarded by the Prevention Branch, National Institute of Mental Health, to the Prevention Center, Department of Mental Hygiene, Johns Hopkins School of Hygiene and Public Health. Principal Investigator: S. G. Kellam, 1994-1999, approximate award 500,000

Co-Principal Investigator, Epidemiological Prevention Center for Early Risk Behavior, awarded by the Prevention Branch, National Institute of Mental Health, to the Prevention Center, Department of Mental Hygiene, Johns Hopkins School of Hygiene and Public Health. Principal Investigator: S. G. Kellam, 1990-1995, approximate award, 5,000,000

Biostatistical Problems in Research Methodology, Samaritan Health Services, Principal Investigator: L.S. Mayer, 1994-95, approximate award 26,000

Biostatistical Problems in Research Methodology, Samaritan Health Services, Principal Investigator: L.S. Mayer, 1993-94, approximate award 25,000

Wharton Support to Litigation Project, awarded by the Office of the Special Counsel, Department of Energy to the Wharton Analysis Center, Wharton School, University of Pennsylvania. Principal Investigator: L.S. Mayer, 1981-83, approximate award: 2,200,000

Wharton Energy Allocation Project, awarded by the Department of Energy to the Wharton Analysis Center, Wharton School, University of Pennsylvania, Principal Investigator: L.S. Mayer, 1981-83, approximate award: 100,000

Wharton Energy Data Analysis Project, awarded by Oak Ridge National Laboratory to the Wharton Analysis Center, Wharton School, University of Pennsylvania, Principal Investigator: L.S. Mayer, 1980-81, approximate award: 450,000

Wharton Petroleum Data Analysis Project, awarded by CEXEC, Inc. to the Wharton Analysis Center, Wharton School, University of Pennsylvania, Principal Investigator: L.S. Mayer, 1980-81, approximate award: 100,000

Wharton Model Evaluation Project, awarded by the Energy Information Administration, Department of Energy to the Wharton Analysis Center, Wharton School, University of Pennsylvania, Principal Investigator: L.S. Mayer, 1979-81, approximate award: 900,000

Wharton Energy Assessment Project, awarded by Oak Ridge National Laboratory to the Wharton Analysis Center, Wharton School, University of Pennsylvania, Principal Investigator: L.S. Mayer, 1980-81, approximate award: 100,000

Princeton Resource Estimation and Validation Project, awarded by the Energy Information Administration, Department of Energy, to the Departments of Statistics and Geology, Princeton University, Principal Investigators: K. Deffeyes, G. Watson, and L. Mayer, 1978-79, approximate award: 450,000

Analysis of Residential Energy Demand, awarded by the Office of Conservation, Department of Energy to the Center for Energy and Environmental Studies, Princeton University, Principal Investigators: R. Socolow, D. Harrje, L. Mayer and F. Sinden, 1977-78, approximate award: 300,000

Analysis of Statistical Issues Arising from Energy Studies, awarded by the National Science Foundation to the Center for Energy and Environmental Studies, Princeton University, Principal Investigator: L.S. Mayer, 1977-78, approximate award: 50,000

Analysis of Residential Energy Demand, awarded by the Energy Research and Development Administration to the Center for Energy and Environmental Studies, Princeton University, Principal Investigators: R. Socolow, D. Harrje and L. Mayer, 1976-77, approximate award: 300,000

Assessing the Value of Econometric Energy Models, awarded by the Department of Commerce to the Center for Energy and Environmental Studies, Princeton University, Principal Investigator: L.S. Mayer, 1976-77, approximate award: 25,000

Energy Husbandry in Residential Housing, awarded by the National Science Foundation to the Center for Environmental Studies, Princeton University, Principal Investigators: R. Socolow, D. Harrje and L. Mayer, 1975-76, approximate award: 300,000

On Comparing Factor Matrices, awarded by the National Institute of Mental Health to the Department of Statistics, Princeton University, Principal Investigator: L.S. Mayer, 1974 - 1975, approximate award: 15,000

Measuring the Relationship Between Abstract Variables, awarded by the National Institute of Mental Health to the Department of Statistics, Virginia Polytechnic Institute and State University, Principal Investigator: L.S. Mayer, 1972-74, approximate award: 15,000

Component Analysis of Variance, awarded by the National Institute of Mental Health to the Behavioral Sciences Laboratory, Ohio State University and the Department of Statistics, Virginia Polytechnic Institute and State University, Principal Investigator: L.S. Mayer, 1971-72, approximate award: 15,000

### **Papers Presented at Professional Meetings:**

Depression in Assisted Living is Common and Related To Physical Burden, Gerontology Society Annual Meeting, Washington DC, November 2004

"Methodological Issues In Modeling The Incidence Of Alzheimer's Disease As A Function Of Age", World Congress of Epidemiology, Toronto, June, 2001

"Biostatistical Problems in Forecasting the Prevalence of Alzheimer's Disease" World Psychiatric Congress, Baltimore, March, 2001

"Using Latent Growth Models and Exploratory Methods to Assess the Relationship Between Responses in a Bivariate Prevention Model (with M. Reiser) Society for Prevention Research, Annual Meeting, Washington DC, May 1997

"Standard Metrics and Methods for Conducting Avian Wind Energy Interaction Studies (with R. Anderson) American Wind Energy Association Conference, Austin Texas, June, 1997

"A Randomized Clinical Trial of a Group Empowerment Program for Somatizing Patients: Six Months Follow-up Results", (with J. C. Peirce, A. Miller and J. Westley), invited lecture, Society for General Internal Medicine, Washington, DC, May 1997

"Measuring Effectiveness: Lessons from Heparinizing Patients with Deep Vein Thrombosis and Pulmonary Embolism" (with J. C. Peirce and R. A. Raschke), invited lecture, Society for General Internal Medicine, Washington, DC, May 1997

"Latent Growth Models of the Impact of Intervention on a Bivariate Longitudinal Response", invited lecture, Society for Research on Child Development, Washington, DC, March, 1997

"Developmental Epidemiology and its Implications for Prevention Research" invited lecture (with Sheppard Kellam), Life History Society Annual Meeting, London, December, 1996

"Standard Methods for Conducting Avian Mortality Studies", with R. L. Anderson, European Wind Energy Conference, Rome, October, 1996

"Using Multilevel Models to Tease Out Variability in Individual Behavior", invited lecture, Association  
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for Clinical Psychosocial Research, American Psychiatric Association, Boston, October, 1996

"Statistical Issues Arising from Application of the Proximal-Distal Model in Prevention Research, Society for Prevention Research, San Juan, Puerto Rico, June, 1996.

"Recent Advances in Prevention Methodology: Multilevel Models", invited lecture, Prevention Methodology Conference, Tempe, Arizona, May 1996

"Advances in the Methods of Prevention Research", invited lecture, National Forum on Prevention, McLean, VA, May, 1996

"Multilevel Models in Prevention Science", invited presentation, Prevention Science Methodology Group meeting, College of Public Health, University of South Florida, Tampa, March, 1996

"Prevented Fractions and Attributable Risk in Proximal Distal Prevention Models", invited lecture, College of Public Health, University of South Florida, Tampa, February, 1996

"Prevented Fractions and Attributable Risks in Preventive Trials", invited paper, Prevention Science and Methodology Conference, Baltimore, MD, October, 1995

"The Use of Epidemiological Measures to Estimate the Effects of Adverse Factors and Preventive Interventions", Workshop on Avian Mortality, Palm Springs, September, 1995

"The Use of Epidemiological Measures to Estimate the Effects of Adverse Factors and Preventive Interventions", invited presentation, Workshop on Avian Mortality and Avian Windpower Planning Meeting, Department of Energy, Palm Springs, September, 1995

"Methodological Advances in Prevention Research", with S. Kellam and J. Anthony, invited symposium, Prevention Research Society, Scottsdale Arizona, June 1995

"Multilevel Modeling and the Development of Aggressive Behavior", invited paper, World Psychiatric Association, New York, May, 1995

"Attributable Risk and Preventive Fractions in Prevention Research", invited lecture, Workshop on the Science of Prevention, NIMH, Baltimore, December, 1994

"Reduction of Aggressive Behavior Among First Graders and Its Consequences for Later Antisocial Behavior and Drug Use", with S. Kellam, H. Chilcoat, J. Anthony, G. Rebok, and N. Ialongo, invited lecture, Society for Prevention Research, Washington, June, 1994

"The Impact of Failure on Boys and Girls: Preventive Intervention Studies on Achievement and Depression" with S. Kellam, G. Rebok, and N. Ialongo, Society for Life History, Durham, November, 1993

"The Course and Malleability of Aggressive Behavior", with S. Kellam, G. Rebok, and N. Ialongo, invited lecture, American Society of Criminology, Annual Meeting, Phoenix, October, 1993

"Mediated Effects in Structural Equation Models", invited paper, American Statistical Association Annual Meeting, August, 1992

"The Course and Malleability of Aggressive Behavior in Young Children", invited presentation, with S. Kellam, et. al., National Academy of Science Institute of Medicine, Committee on Prevention of Mental Disorders, June, 1992

"Developmental Epidemiology and the course of Aggressive Behavior", Life Course Development Society, Philadelphia, April, 1992

"Modeling the Cotemporal Effects in a Cross-Lagged Panel Model", ASA Annual Meeting, New Orleans, August, 1988

"Estimating Multivariate Continuous Variable Panel Models", ASA Annual Meeting, San Francisco, August, 1987

"Inferences in Cross-Lagged Panel Models," invited paper, AIDS Convention, Phoenix, March, 1986

"Recent Advances in Cross-Lagged Panel Analysis," invited lecture, Southwest Social Science Convention, San Antonio, March, 1986

"Hypothesis Testing with Continuous Variable Panel Data," Annual Meeting, Biometrics Society (WNAR), San Luis Obispo, June, 1985

"Multivariate Cross-Lagged Panel Models: Does IQ Cause Achievement?" invited lecture, Regional Meeting, Institute of Mathematical Statistics, Humboldt State University, Arcata, CA, June, 1983

"Analysis of the U.S. Short-Term Integrated (Energy) Forecasting System," invited lecture, International Energy Conference, Berlin, October 1981

"Assessing Energy Models: A Policy Process Approach," invited lecture, Workshop on Energy Model Validation, National Bureau of Standards, January 1979

"Energy Use and Potential for Conservation," (with David Harrje et al.), invited lecture, International Conference on Energy Use Management, Tucson, October 1977

"Large Data Sets and the Meta-Theorems of Exploratory Data Analysis," invited lecture, American Statistical Association, Special Topic Meeting, Dallas, 1977

"The Internalization of Cosmopolitan-Local Orientations Among College Students," (with W. Snizek), invited lecture, Southern Sociological Association, Washington, D.C., April 1975

"Equivalent Estimation and a Special Group Structure," (with T. Woteki), invited lecture, Regional Meeting, Institute of Mathematical Statistics, Minneapolis, March 1975

"The Use and Abuses of Probability in Voting Theory Models," invited lecture, Annual Meeting, Public Choice Society, New Haven, April 1974

"Some Problems with the Theory of Coalitions as Applied to the Judiciary," invited paper, Annual Meeting, American Political Science Association Convention, Chicago, August 1974

"On Principal Components and Clusters," invited lecture, Annual Meeting, International Classification Society, Atlanta, Georgia, April, 1973

"On Biased Estimation in Linear Models," invited lecture, Annual Meeting, American Statistical Association, New York, December, 1973

"Invariant Estimation with Applications to Linear Models," (with M.S. Younger), Institute of Mathematical Statistics, Blacksburg, Virginia, Academy of Science, May, 1972

"On Biased Estimation in Linear Models," invited lecture, Virginia Academy of Science, Lexington, Virginia, May, 1972

"Methods of Cluster Analysis Which Utilize Principle Components," invited lecture, International Classification Society Convention, Chicago, Illinois, April 1972

"A Method of Cluster Analysis," invited lecture, Annual Meeting, Biometrics Society, Fort Collins, Colorado, August, 1971

"Measures of Association," invited lecture, International Studies Association, San Juan, Puerto Rico, March, 1971

"Utilizing Initial Estimates in Estimating the Coefficients in a General Linear Model," Annual Meeting, Institute of Mathematical Statistics, Laramie, Wyoming, August 1970

**Speeches, Presentations, Lectures and Colloquia:**

"Validating Biomarkers in Psychiatry", Department of Psychiatry, University of Athens, Athens, Greece, October, 2006

"Fitting Failure Models to the Incidence of Alzheimer's Disease: Methodological Problems", invited lecture, Johns Hopkins School of Public Health, Noon conference series on Mental Health, January, 2001

"Psychiatric Epidemiology", Residency Program in Psychiatry, Samaritan Health System, September, 2000

"Critical Appraisal in Internal Medicine", invited speaker, Good Samaritan Internal Medicine Program. April, 2000

"Psychiatric Epidemiology", Residency Program in Psychiatry, Samaritan Health System, September, 1999

"Tradeoffs Between Latent Growth Models and Epidemiological Models of Preventive Interventions, invited colloquium, Department of Mental Hygiene, Johns Hopkins School of Hygiene and Public Health, October, 1998

"Psychiatric Epidemiology", Residency Program in Psychiatry, Samaritan Health System, September, 1998

"Advances in Psychiatric Epidemiology", Clinical Epidemiology Section, Royal Medical Society (Edinburgh), August, 1998

"Latent Growth Models and Attributable Risks", luncheon speaker, Fellowship in Drug Epidemiology, Johns Hopkins University, April 1998

"Attributable Risk Measure in Mediational Impact Models: Somatizing Behavior", invited colloquium, Department of Mental Hygiene, Johns Hopkins School of Hygiene and Public Health, March, 1998

"Statistical Issues in Using Attributable Risk Measures in Intermediate Outcome Models", Page 22 of 30

Department of Statistics, The University of Lancaster, Lancaster, England, June, 1997

"Statistical Problems that Arise in Applying Intermediate outcome Models in Prevention Research", invited lecture, Department of Statistics, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, May, 1997

"The Epidemiology of Thyroid Disease", invited lecture, Grand Rounds in Endocrinology, Samaritan Health Services, April, 1997

"Attributable Risk and Preventive Fractions in Prevention Research", invited lecture, Workshop on the Science of Prevention, NIMH, Baltimore, December, 1994

"Advances in Prevention Methodology", invited lecture, Prevention Research Center, Johns Hopkins University, September, 1994

"Multi-level Modeling in Prevention Research", invited colloquium, Prevention Research Center, Arizona State University, April, 1994

"Multi-level Modeling of Health Data; The Effects of Intervention on Aggressive Behavior", invited lecture, Program in Developmental Biology, University of North Carolina, April, 1994

"Mediation in Intermediate Variable Models", Department of Epidemiology and Biostatistics, College of Public Health, University of South Florida, March, 1994

"Assessing the Impact of Interventions on Proximal and Distal Outcomes" NIMH Prevention Research Center Directors Meeting, October 1993 with Reiser, M. and Warsi, G

"Epidemiology and Social Methodology: Complementarity in Prevention Research", invited presentation, with S. Kellam, et. al., NIMH Prevention Research Conference, Tysons Corners, VA, April, 1993

"Statistical Issues in Prevention Research", invited lecture, Directors' Meeting, Prevention Research Center Directors Meeting, National Institute of Mental Health, Rockville, Maryland, October, 1992

"The Course and Malleability of Aggressive Behavior in Young Children", invited presentation, with S. Kellam, et. al., National Academy of Science Institute of Medicine, Committee on Prevention of Mental Disorders, June, 1992

"Causal Models in Prevention Research: Mediation Moderation and Confounding", invited seminar, Carl A. Taube Memorial Colloquium Series in Psychiatry and Mental Health, Johns Hopkins University, May, 1992

"Breast Implants, Risk Surveillance and Health Statistics", invited lecture, MBA Special Colloquium Series, Arizona State University, March, 1992

"Proximal/Distal Effects on Two Developmental Epidemiologically-Based Preventive Interventions", invited seminar, Colloquium Series in Mental Health, Johns Hopkins School of Hygiene and Public Health, February, 1992

"Analyzing Subgroups and Contextual Effects" [with Sheppard Kellam], invited presentation, Directors' Meeting, Prevention Research Center Directors Meeting, National Institute of Mental Health, Rockville, Maryland, September, 1991

"Proximal/Distal Effects on Two Developmental Epidemiologically-Based Preventive Interventions" [with Sheppard Kellam, et. al.], invited seminar, Carl A. Taube Memorial Colloquium Series in Mental Health, Johns Hopkins School of Hygiene and Public Health, September 1991

"The Epidemiology of Preventive Care in the Workplace", invited lecture, Phoenix Chapter, Association of Corporate Fitness Directors, Phoenix, May 1991.

"Statistics, Medicine and the Law", Invited Lecture, East Mesa Doctors Club, November 1990

"Statistical Models in the Analysis of Panel Data", invited lecture, Department of Biostatistics, Johns Hopkins School of Hygiene and Public Health, April, 1990

"Applications of Statistics to Occupational Health Problems", invited lecture, Department of Statistics, MacQuarie University, Australia, October, 1989

"Panel Models and Policy Analysis", invited lecture, Lincoln College, Christchurch, New Zealand, September 1989

"Panel Analysis and Occupational Health Analysis", invited lecture, University of Otago, New Zealand", September 1989

"Current Trends in Data Analysis, invited lecture, MBA colloquium, University of Canterbury, Christchurch, New Zealand, September 1989

"Managing the Health of Workers and the Health of the Firm", invited banquet speech, Conference on Analysis of Occupational Health Risks, Phoenix, August 1987

"Panel Models, Covariance Structures and the Exclusion of Liberals from 'Death-Sentence' Juries", invited colloquium, Department of Statistics, Stanford University, August, 1986

"A Statistician Looks at Panel Analysis or a Perfidious Peek at Pundits and Pookas," invited lecture, Arizona Chapter, American Statistical Association, March, 1984.

"A Statistician Looks at Panel Analysis", invited lecture, College of Business, University of Tennessee, June, 1983

"The Use of Panel Models in Non-experimental Research", invited lecture, College of Medicine, University of California, San Francisco, June, 1983

"Competing Approaches to Analysis of Panel Data", invited lecture, Econometrics Seminar, Stanford University, May 1983

"Science Analysis in Politics and the Politics of Science Analysis", invited lecture, Butler University, Indianapolis, March, 1983

"Statistical Problems in Panel Models", invited lecture, College of Education, Stanford University, March, 1983

"A Statistician Looks at Panel Analysis or a Perfidious Peek at Pundits and Pookas", invited lecture, Department of Computer and Information Sciences, University of California, Santa Cruz, February, 1983

"A Statistician Looks at Panel Analysis or a Perfidious Peek at Pundits and Pookas", invited lecture, Department of Computer and Information Sciences, University of Santa Clara, February, 1983

"Statistical Problems in Panel Analysis", invited lecture, Department of Mathematics, University of California, Santa Barbara, February, 1983

"A Statistician Looks at Panel Analysis", invited lecture, Department of Statistics, University of Arizona, February, 1983

"A Crossed Lagged Penal Analysis of Cross-Lagged Panel Analysis", invited colloquium, Department of Statistics, Stanford University, January, 1983

"Some Exciting Problems in Energy Modeling", invited lecture, Department of Mathematics, Arizona State University, August, 1982

"Statistical Problems in Short-term Energy Forecasting", invited lecture, Energy Information Administration, Washington, D.C., February, 1982

"Problems in Forecasting Energy Supplies", Decision Sciences Seminar, Wharton School, September, 1981

"Energy Policy: Myth and Reality", invited lecture, Philadelphia Business Seminar, April, 1981

"Energy Management: Building Image and Minimizing Liabilities", invited lecture, Wharton Executive Development Seminar, April, 1981

"Evaluating Energy Models", invited lecture, Delaware Chapter, American Statistical Association, University of Delaware, May, 1980

"Evaluating Models of Resource Depletion", invited lecture, Department of Economics, New York University, April, 1980.

"Exploratory Methods and the Art of Data Analysis", Dinner speech, Philadelphia Chapter, American Statistical Association, October, 1979

"Models of Domestic Oil Resources: Science Products and Political Agents", invited lecture, Thayer School of Engineering, Dartmouth College, March, 1979

"Models of Sequential Voting", invited lecture, Department of Political Science, Dartmouth College, March, 1979

"Estimating Oil Reserves: The Methods, Models and Policy Issues", invited lecture, School of Public and Urban Policy, University of Pennsylvania, December, 1978

"Estimating the Domestic Crude Oil Resource Base: Examining the King's Approach", invited lecture, Department of Statistics, University of Pennsylvania, November, 1978

"Picking a Multivariate Test Function, The Eenie-Meany Principle", invited lecture, Montreal Joint Statistics Colloquium, Montreal, November, 1977

"Econometric Energy Models: The Emperor's Quantitative Suit", invited lecture, Department of Commerce, October, 1977

"Exploratory Data Analysis as an Alternative to the Econometric Analysis of Social Problems," invited lecture, Department of Psychology, College of William and Mary, April, 1977

"Analyzing Energy Policy: The Competing Roles of the Economist, Engineer and Mathematician", invited lecture, Department of Mathematics, University of South Carolina, April, 1977

"Analyzing Political Data: What Can Statistics Tell Us?," invited lecture, School of International Studies, University of Denver, May, 1976

"Schur-Convexity and the Equivalence of Multivariate Tests", invited seminar, Department of Statistics, Rutgers University, October, 1975

"On Communal Indifference Curves," (with I.J. Good), invited seminar, Mathematical Economics Seminar, Virginia Polytechnic Institute and State University, October, 1975

"The Statistical Analysis of Energy Problems: Who Should We Believe?", invited lecture, Office of Energy Analysis, Department of Commerce, October, 1975

"Energy Research and Residential Housing", invited lecture, The Federal Energy Administration, September, 1975

"Consumer Reaction to the Energy Crisis: The Long Underwear Effect", invited address, West Virginia University, February, 1975

"Mathematical Models and other Forms of Hocus-Pocus", invited lecture, Department of Political Science, West Virginia University, February, 1975

"Factor Analysis: The Short Bed Problem", invited lecture, Department of Statistics and Operations Research, University of Pennsylvania, March, 1975

"LSD and Political Science: Distinguishing Uppers and Downers", invited address, Western New England College, November, 1974

"Probability, Statistics and the Theory of Democracy", invited lecture, Department of Statistics, University of Connecticut, October, 1974

"Statistical Policy Analysis: Assessing the Unobservable", invited lecture, Department of Statistics, Princeton University, January, 1974

"On Procedures for Comparing Factor Matrices", invited lecture, Department of Statistics, University of Connecticut, January, 1974.

"A Mathematician's Doubts About Econometric Solutions to Political Problems", invited lecture, Department of Political Science, Ohio State University, May, 1973

"Estimating the Relationship Between Unobserved Variables, or Can We Sell the Second Canonical Correlation to the Social Scientists?", invited lecture, Department of Statistics, Ohio State University, May, 1973

"Generalized Spatial Models of Voting Theory", invited lecture, Center for Public Choice, Virginia Polytechnic Institute and State University, February, 1973

"Estimating the Relationship Between Ordinal Variables", invited lecture, Department of Statistics, Harvard University, 1973.

"Some Statistical Problems in Spatial Models", invited colloquium, Department of Statistics, Carnegie-Mellon University, Pittsburgh, October, 1972.

"Sex, the Generation Gap, and Fermat's Last Theorem", invited speech, Tidewater Council of Teachers of Mathematics, Norfolk, Virginia, September, 1972

"Mathematics: Is it Irrelevant by Necessity or Design?", invited lecture, Department of Mathematics, Emory and Henry College, Emory, Virginia, April, 1972

"Is There Reason for a Mathematician to help a Social Scientist?", invited to deliver annual Phi Mu Epsilon Lecture, Blacksburg, Virginia, 1972

"Probability Without Calculus and Statistics Without Mathematics", invited lecture, Virginia Mathematics Teachers Annual Convention, Roanoke, Virginia, November, 1972

"If Educators Educate Educators, Who Educates the Educated?", banquet address, State Mathematics Teachers Convention, Norfolk, Virginia, 1971

"Two-Stage Estimation in linear Models", invited lecture, Department of Statistics, Pennsylvania State University, January, 1971

"Problems in Cluster Analysis", invited lecture, Department of Applied Statistics, University of Minnesota, January 1971

#### **Papers in Proceedings:**

Mayer, L. S. and Reiser M.(1992) "Mediation and Confounding in Panel Models of Prevention Research" Proceedings of the Social Statistics Section, American Statistical Association

Mayer, L. S. and Carroll, S. S.(1988) "Modeling the Cotemporal Effect in a Cross-Lagged Panel Model," Proceedings of the Business and Economics Section, American Statistical Association

Carroll, S. S. and Mayer, L. S. (1987) "Testing for Serial Correlation in Cross-Lagged Panel Studies," Proceedings of the Business and Economics Section, American Statistical Association

Carroll, S. S. and Mayer, L. S. (1986) "Evaluation of the Cross Effects Parameters in a Cross-Lagged Panel Model," Proceedings of the Business and Economic Section, American Statistical Association

Mayer, L. S. (1985) "Hypothesis Testing in Cross-Lagged Panel Models," Proceedings of the Social Statistics Section, American Statistical Association

Mayer, L. S. and Carroll, S. S. (1985) "Testing for Serial Correlation in Cross-Lagged Panel Studies," Proceedings of the Business and Economics Section, American Statistical Association

Mayer, L.S. et. al. (1982). "Analysis of the U.S. Short-Term Integrated (Energy) Forecasting System," Proceedings of the International Conference on Energy Use Management, New York: Pergamon Press, 971-982

Harrie, D. and Mayer, L.S. (1978). "Energy Use and the Potential for Conservation," Proceedings  
Page 27 of 30

of the International Conference on Energy Use Management, Volume II, R. Fazzolare and C. Smith (eds.), New York: Pergamon Press, 749- 771

Mayer, L.S. (1978). "The Use of Semi-Controlled Experiments in the Analysis of Residential Energy Demand," Proceedings of the 1978 Department of Energy Symposium, Washington: Government Printing Office

Mayer, L.S. (1978). "The Value of the Econometric Approach to Forecasting Our Energy Future," Proceedings of the International Conference on Energy Use Management, Volume III, R. Fazzolare and C. Smith (eds.), New York: Pergamon Press, 1073-1082

Mayer, L.S. (1978). "Difficulty in Developing Local Energy Policy," expert testimony, Hearings on Local Energy Policy, Washington: U.S. Congress

Mayer, L.S. (1977). "Exploratory Data Analysis and Classical Statistics: Their Abilities to Shed Light on Energy Issues," Proceedings of the 1977 Department of Energy Symposium, 27-32, Washington: Government Printing Office

#### **Published Abstracts:**

"Equivariant Estimation and A Special Group Structure", (with T. Woteki), Bulletin of the Institute of Mathematical Statistics, 1975

"A Fortran Program for Linear Log Odds Analysis", (with P.J. Pichotta), Behavior Research Methods and Instrumentation, 1974, 6, p. 521

"Invariant Estimation in the Social Sciences", (with M. S. Younger), Bulletin of the Institute of Mathematical Statistics, 1973

"On Principal Components and Clusters", Bulletin of the International Classification Society, 1973

"Methods of Cluster Analysis Which Utilize Principal Components", Bulletin of the International Classification Society, 1972

"Utilizing Initial Estimates in Estimating the Coefficients in General Linear Model", Annals of Mathematical Statistics, October 1970

#### **Society Membership:**

Society for Epidemiological Research, Society for Environmental Epidemiology, Royal Statistical Society, Society for Medical Decision Making, American Statistical Association, Biometrics Society, Institute for Mathematical Statistics, Psychometric Society, Econometric Society, American Association for the Advancement of Science, American Political Science Association, American Sociological Association, and Council for Applied for Social Research.

#### **Courses Taught at Arizona State University and Banner Good Samaritan Medical Center**

Epidemiology, Epidemiology Methodology, Clinical Epidemiology, Panel Analysis, Biostatistics, Multiple Regression, Time Series Modeling, Applied Forecasting Methods, Stochastic Processes, Exploratory Data Analysis, Seminar in Multivariate Analysis, Advanced Topics in Statistical Inference, Advanced Topics in Linear Models, Advanced Research Methods.

#### **Courses taught at other Universities:**

Undergraduate:

Biostatistics, Data Analysis, Nonparametric Methods, Regression Analysis, Mathematical Statistics, Mathematical Modeling, Design of Experiments, Statistics for the Social Sciences, Educational Statistics, Statistics and Public Policy, Computers and Society, Forecasting.

Graduate:

Biostatistics, Clinical Epidemiology, Statistical Forecasting, Exploratory Data Analysis, Epidemiological Methods, Econometrics, Applied Multivariate Statistics, Advanced Multivariate Statistics, Stochastic Processes, Advanced Probability, Linear Models, Advanced Inference, Time Series, Sampling Theory, Quantitative Methods of Policy Analysis, Philosophy of Science, Advances in Social Methodology.

Professional:

Statistics and Public Policy (Woodrow Wilson School, Princeton University); Advanced Study in Energy Analysis (Wharton MBA Program, University of Pennsylvania); Advanced Study in Statistics and Law (Law School, University of Pennsylvania); Medical Statistics (College of Medicine, Ohio State University)

**Notable University Committees:**

Member, Graduate Committee on Ph.D. program in Health Services Administration and Policy, Arizona State University (ASU) 1991-1992

Member, Executive Board, Program on Law and the Social Sciences, ASU, 1983-1989

Faculty Senate (elected), ASU, 1987-89

University Services Committee, ASU, 1988-89

Council on Research and Creative Activities, ASU, 1986-1988

Sunset Review Committee, Meteorite Center, ASU, 1987

Sunset Review Committee, Energy Research Center, ASU, 1987

Chair, Sunset Review Committee, Center for Advanced Research in Transportation, ASU, 1987

Women Studies Research Awards Committee, ASU, 1984-1989

Board, Ph.D. Program in Justice Studies, ASU, 1987-1989

Biomedical Research Committee, ASU, 1986-1988

**Notable Previous University Committee Assignments:**

Member, Health Professions Advisory Board, University of Pennsylvania, 1980-83

Member, Environmental Task Force Committee, Office of the Provost, University of Pennsylvania, 1979-82

Member, Committee on Undergraduate Student Life, Princeton University, 1976

Member, Council of Masters, Princeton University, 1976-79

Fellow, Princeton Inn College, Princeton University, 1975-76

Member, Chair Search Committee, Department of Statistics, Virginia Polytechnic Institute and State University, 1972-74

*Lawrence S. Mayer, MD, PhD*  
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Phoenix, AZ 85018  
602-549-4885  
lsmmphd@gmail.com

LSM appearances and depositions for the previous four years updated 9 August 2016:

1. Appearances: None

2. Depositions:

*Dean Mostofi, Pro Se, v. Whole Foods Market Group*, Superior Court of the District of Columbia, No. 2011 CA 0000369 B, held on the June 14<sup>th</sup>, 2012 in Washington DC.

**ROBERT ANTHONY NORMAN, SR v. ASBESTOS DEFENDANTS, CIVIL DISTRICT COURT, PARISH OF ORLEANS, STATE OF LOUISIANA, NO. 2007-15314**, held on the July 16<sup>th</sup>, 2012, in New Orleans, LA.

**DELORES TIETZ and MILTON TIETZ v. ABBOTT LABORATORIES, CIRCUIT COURT OF COOK COUNTY, ILLINOIS , COUNTY DEPARTMENT, LAW DIVISION, No. 12L-0002715**, held on November 12, 2012 held on the 3<sup>rd</sup> January, 2013 in Phoenix, AZ.

**Bell v. Celestino**, Circuit Court for Miami-Dade County, No. 09-43951 CA 10, held on the May 16<sup>th</sup>, 2013 in Miami, FL.

**Roberts v. Fredericksburg Healthcare**, Circuit Court for the County of Spotsylvania, Virginia, no. CL 11-1288, held on the 3<sup>rd</sup> April, 2013 in Phoenix, AZ.

**Sowards v. Las Cruces Medical Center**, Third Judicial District Court, County of Dona Ana, State of New Mexico, no. D-307-CV-2009-02563, held on the 13<sup>th</sup> October, 2013 in Phoenix, AZ.

**Sowards v. Las Cruces Medical Center**, Third Judicial District Court, County of Dona Ana, State of New Mexico, no. D-307-CV-2009-02563, held on the 15<sup>th</sup> July, 2014 in Phoenix, AZ.

**Hilverding v. Steptodont, Inc. and Novocol Pharmaceutical of Canada, Inc.**, Court of Fulton County, State of Georgia, No. 13EV018074B, held on the 15<sup>th</sup> January, 2015 in Phoenix AZ.

**Hilverding v. Steptodont, Inc. and Novocol Pharmaceutical of Canada, Inc.**, State Court of Fulton County, State of Georgia, No. 13EV018074B, held on the 10<sup>th</sup> February, 2015 in Annapolis, MD.

**Prelas v Mercedes Benz, USA, LLC**, Circuit Court, Boone County, State of Missouri, O9BA-CV2409, held on 17<sup>th</sup> April 2015, Phoenix, AZ.

**Hilverding v Septodont, et. al**, State Court of Fulton County, State of Georgia, Civil Action NO. 13EV018074B, held on the 31<sup>st</sup> August, 2015 in Annapolis, MD.

**Hyoung v Target Corporation**, SUPERIOR COURT OF THE STATE OF CALIFORNIA FOR THE COUNTY OF LOS ANGELES, State of California, No. NC0580059, Laguna Hills, CA, held on the 6<sup>th</sup> January, 2016, Laguna Hills, CA.

**Environmental Research Center Aloe Vera of America** SUPERIOR COURT OF THE STATE OF CALIFORNIA, COUNTY OF SAN FRANCISCO, State of California, held on the 20<sup>th</sup> January 2016, San Francisco, CA.